

ESTTA Tracking number: **ESTTA701630**

Filing date: **10/12/2015**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE TRADEMARK TRIAL AND APPEAL BOARD

Proceeding	91200832
Party	Plaintiff Briggs & Stratton Corporation and Kohler Co.
Correspondence Address	ROBERT N PHILLIPS REED SMITH LLP 101 SECOND ST, STE 1800 SAN FRANCISCO, CA 94105 UNITED STATES ipdocket-chi@reedsmith.com, nborders@reedsmith.com, robphil- lips@reedsmith.com, knowakowski@whdlaw.com, dkalahele@rddsmith.com, ebridge@whdlaw.com, mgi
Submission	Testimony For Plaintiff
Filer's Name	Robert N. Phillips
Filer's e-mail	robphillips@reedsmith.com, sherring@reedsmith.com, dkala- hele@reedsmith.com
Signature	/s/ Robert N. Phillips
Date	10/12/2015
Attachments	6.24.2015 Jeff Whitmore Deposition Transcript (Revised).pdf(6500 bytes) 6.24.2015 Jeff Whitmore - Opposers' Trial Exhibits 1 through 12.pdf(1616400 bytes) 6.24.2015 Jeff Whitmore - Applicant's Trial Exhibit Nos. 1 through 9.pdf(1812678 bytes)

Briggs & Stratton Corporation and Kohler
Company

v.

Honda Giken Kogyo Kabushiki Kaisha

Opposition No. 91200832 (Parent)

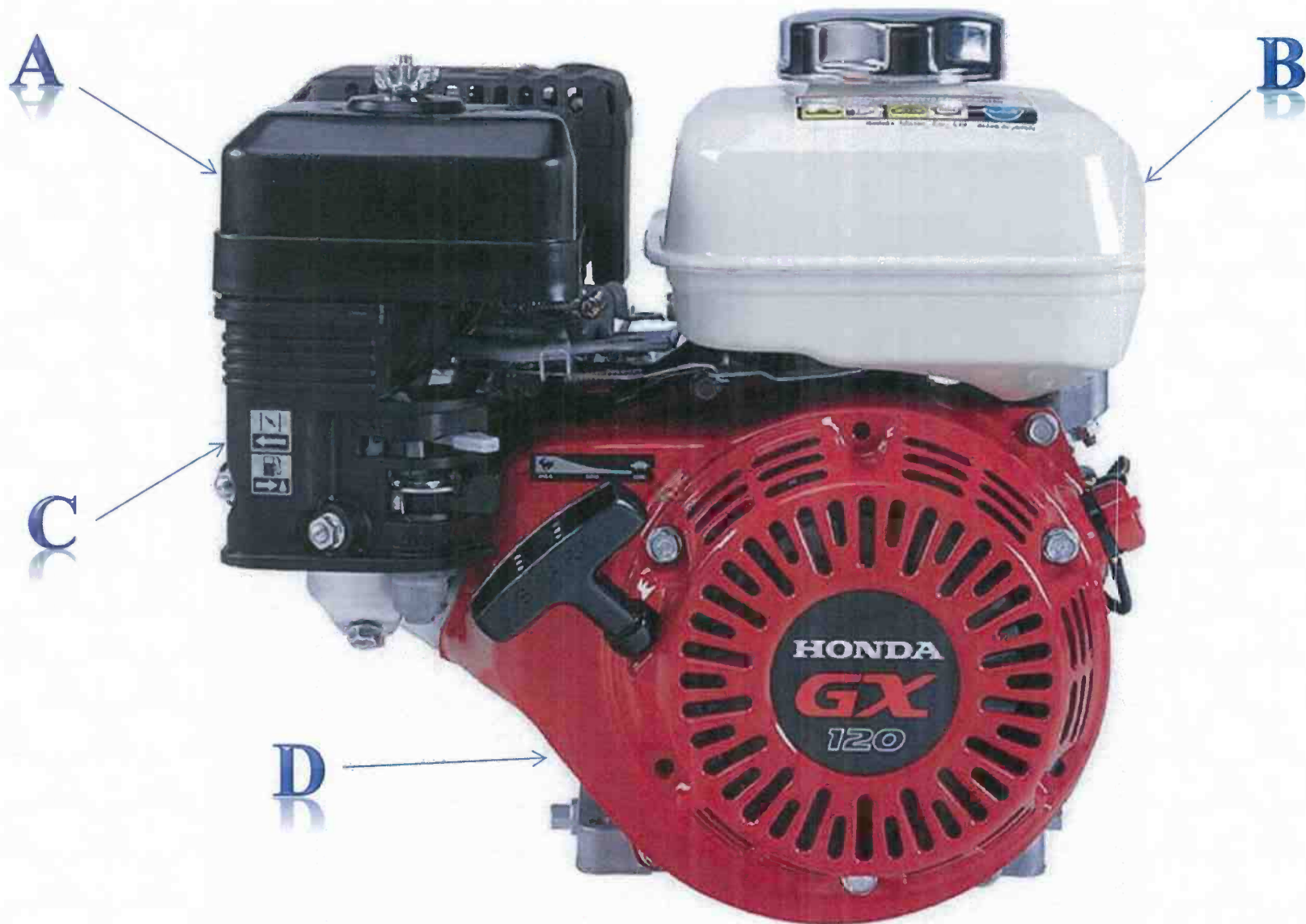
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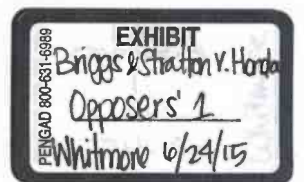
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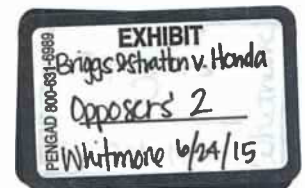


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Opposers' Trial Exhibit No. 3

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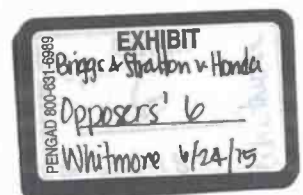
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EXHIBIT
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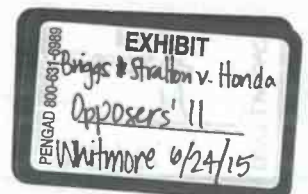
GENERAC®

POWER WASHERS



2500 – 3100 PSI

residential



residential power washers

Generac residential power washers give you cleaning power, reliability and—above all—ease of use in an affordable, compact unit you can use to clean everything from patio furniture to driveways and decks. The user-friendly design makes it easy to assemble, connect hoses, move almost effortlessly regardless of terrain, and clean longer and more comfortably.

**Quick-Click™ Nozzle tips**

Up to five (depending upon model) for tackling any job

Integrated spray gun holder

Holds spray gun securely during transport and storage

Ergonomic spray gun

Cushion grip and easy-to-pull trigger reduce fatigue and improve comfort

High Pressure hose

Connects to the rear of the spray gun for maximum convenience

Easy maneuverability

Engine and pump are perfectly balanced over the axle for almost effortless maneuverability

User friendly controls

All in a single location, including on/off, choke, and fuel shutoff

Powerful Generac OHV horizontal-shaft engine

For maximum cleaning performance

Convenient on-board detergent tanks

$\frac{3}{4}$ gallon (2800PSI and 3100PSI unit only)

Unique foot rest

Stabilizes the unit during startup

Easy-access axial cam pump

No more kneeling on the ground to connect hoses

what's included

- Power washer
- Wand
- Hose
- Nozzle tips
- Engine oil supply
- Owner's manual



Engineered Specifically to Meet Customer Needs

ACCESS

Because every Generac residential power washer features a Generac OHV horizontal-shaft engine, the pump is well above the ground at the same level as the engine, making hose connections a snap—unlike vertical-shaft engines, where the hose connections are under the engine and more difficult to reach.



MOBILITY

We designed our residential power washers so the engine and pump are perfectly balanced over the axle for almost effortless maneuverability, regardless of the terrain.

COMFORT

Generac designed the spray gun with ergonomics in mind. The cushion grip improves comfort during cleaning. And you can hold the easy-to-pull spray trigger with minimal effort, reducing fatigue.



CHOOSE THE GENERAC POWER WASHER BELOW THAT MEETS YOUR CLEANING NEEDS.

RECOMMENDED USE*																	
	PSI	GPM															
RESIDENTIAL	2500	2.3	■	■	■	■	■	■	■								
	2800	2.5	■	■	■	■	■	■	■	■							
	3100	2.8		■	■	■	■	■	■	■	■	■					

*Carbon monoxide produced during use CAN KILL IN MINUTES. NEVER use indoors or in the sheltered areas, EVEN IF doors and windows are open. Only use OUTSIDE, and far away from windows, doors and vents. READ MANUAL BEFORE USE for important details on safe operation.

power washer specifications

PSI	2500	2800	3100
Model Number (49-State/CARB)	6595	6596/6597	6598/6599
GPM	2.3	2.5	2.7
Cleaning Power (PSI x GPM)	5750	6210	8370
Engine	196cc Generac OHV	196cc Generac OHV	212cc Generac OHV
Pump	Axial cam	Axial cam	Axial cam
Generac-designed Spray Gun	Ergonomic spray gun	Ergonomic spray gun	High-performance spray gun
High-Pressure Hose	25'	25'	30'
Soap Tanks	Siphon hose	(1) 3/4 gallon tank	(2) 3/4 gallon tanks
Quick-Click™ Nozzle Tips	0°, 25°, soap	0°, 25°, 40°, soap	0°, 15°, 25°, 40°, soap
Wheels	10" solid	10" solid	10" solid
Warranty	2 years	2 years	2 years
Weight	68 lbs. (30.8 kg)	69 lbs. (31.3 kg)	74 lbs. (33.6 kg)
Dimensions (L x W x H) (in/cm)	23.3" x 16" x 40" (59 cm x 40.6 cm x 102.2 cm)	23.3" x 16" x 40" (59 cm x 40.6 cm x 102.2 cm)	23.3" x 16" x 40" (59 cm x 40.6 cm x 102.2 cm)

A Tradition of Quality and Innovation

For over 50 years, Generac Power Systems has been a leader in innovative design and superior manufacturing. When it comes to developing products that are both durable and reliable, we stand head and shoulders above our competition. The result of our efforts can be seen across our many product offerings.

We design and build engine-driven power generation equipment, automatic transfer switches, control systems, air-cooled engines and power washers.

Regardless of the product, our vertical integration allows us to control the quality, availability and flow of materials throughout the manufacturing process. And each product is factory tested prior to shipment. It is this ongoing commitment to quality and innovation that has made Generac a name that people have come to trust.

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Generac power washers are supported through an extensive nationwide service network that provides parts and technical support to homeowners and contractors. For a power washer dealer near you, visit generac.com.

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2500PSI Power Washer (2.3 GPM)

With its large Generac OHV horizontal shaft engine and easy-access axial cam pump, the 2500PSI power washer is ideal for cleaning everything from patio furniture to siding to decks around the house.

Ergonomic Spray Gun



- Cushion grip for comfort
- Easy-to-pull trigger reduces fatigue
- Rear hose connection for maximum convenience

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NYSE:GNRC \$33.49 12/27/2012 3:37pm EST

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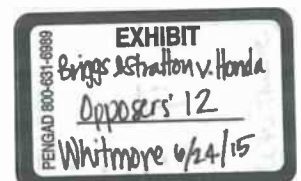
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- + Large 196cc Generac OHV horizontal shaft engine
- + Ergonomic spray gun
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- + 10" wheels
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- + User friendly controls

2500PSI Rear View

- + Easy-access axial cam pump
- + 25' PVC hose
- + Integrated spray gun holder



Click a feature or image hot-spot to view details.

E2



US007441532B2

(12) **United States Patent**
Disch et al.

(10) **Patent No.:** **US 7,441,532 B2**
(45) **Date of Patent:** **Oct. 28, 2008**

(54) **FOUR-STROKE INTERNAL COMBUSTION
ENGINE HAVING REDUCED NOISE
EMISSIONS**

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5,059,221 A 10/1991 McWilliam
5,134,977 A 8/1992 Bagger et al.

(75) Inventors: **Tom Disch**, Brookfield, WI (US);
Jeffrey P. Feist, Pewaukee, WI (US);
Kayne Kowis, Hartland, WI (US); **Elliot**
Matel, Milwaukee, WI (US); **Robert J.**
Rose, Hartford, WI (US); **Marvin**
Visser, Oak Creek, WI (US); **Jeffrey H.**
Whitmore, Shorewood, WI (US);
Geoffrey P. Zabrowski, Racine, WI
(US)

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Primary Examiner—Thomas N Moulis

(74) *Attorney, Agent, or Firm*—Michael Best & Friedrich
LLP

(21) Appl. No.: **11/354,633**

(22) Filed: **Feb. 15, 2006**

(65) **Prior Publication Data**

US 2007/0186894 A1 Aug. 16, 2007

(51) **Int. Cl.**
F02M 77/04 (2006.01)
F02M 77/11 (2006.01)

(52) **U.S. Cl.** **123/198 E**

(58) **Field of Classification Search** 123/198 E,
123/43; 181/204

See application file for complete search history.

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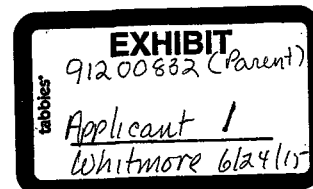
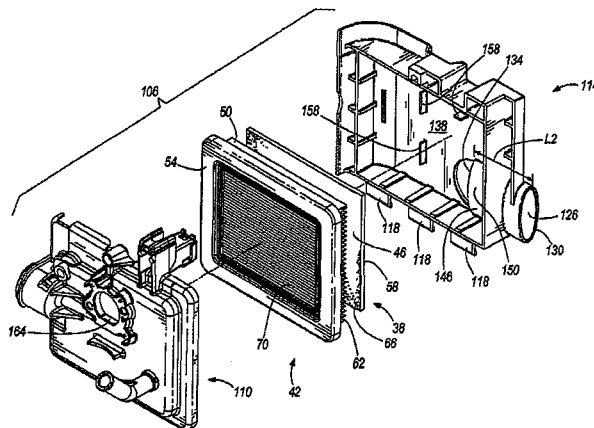
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(57) **ABSTRACT**

The present invention provides a four-stroke internal combustion engine having reduced noise emissions. The engine includes a filter element having substantially flat inlet and outlet sides, a first housing portion, and a second housing portion coupled to the first housing portion. The first and second housing portions define an air chamber in which the filter element is supported. The second housing portion includes an interior surface, at least one protrusion to space the inlet side of the filter element from the interior surface, and an air passageway. The outlet of the air passageway is positioned adjacent the interior surface to deliver air to the air chamber between the interior surface and the inlet side of the filter element. A ratio of the volume of the air chamber to the length of the air passageway is between about 5 in² and about 20 in².

8 Claims, 11 Drawing Sheets



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 Figs. 1-3 illustrate an air cleaner from a Honda Model EU1000i generator commercially available at least as early as 2001.
 Figs. 4-6 illustrate an air cleaner from a Honda Model EU2000i generator commercially available at least as early as 2001.
 Figs. 7-9 illustrate an air cleaner from a Yanmar Model GA180 engine commercially available at least as early as 2005.
 Figs. 10-11 illustrate an air cleaner from a Tecumseh engine commercially available at least as early as 1979.
 Figs. 12-13 illustrate an air cleaner from a Mitsubishi Heavy Industries Model No. 245432 engine commercially available at least as early as May 18, 2005.
 Figs. 14-15 illustrate an air cleaner cover from a Briggs & Stratton Model 13 engine commercially available at least as early as Aug. 14, 1992.
 Figs. 16-17 illustrate an air cleaner cover from a Briggs & Stratton Model 9U and Model 11U engine commercially available at least as early as Nov. 1, 1983.

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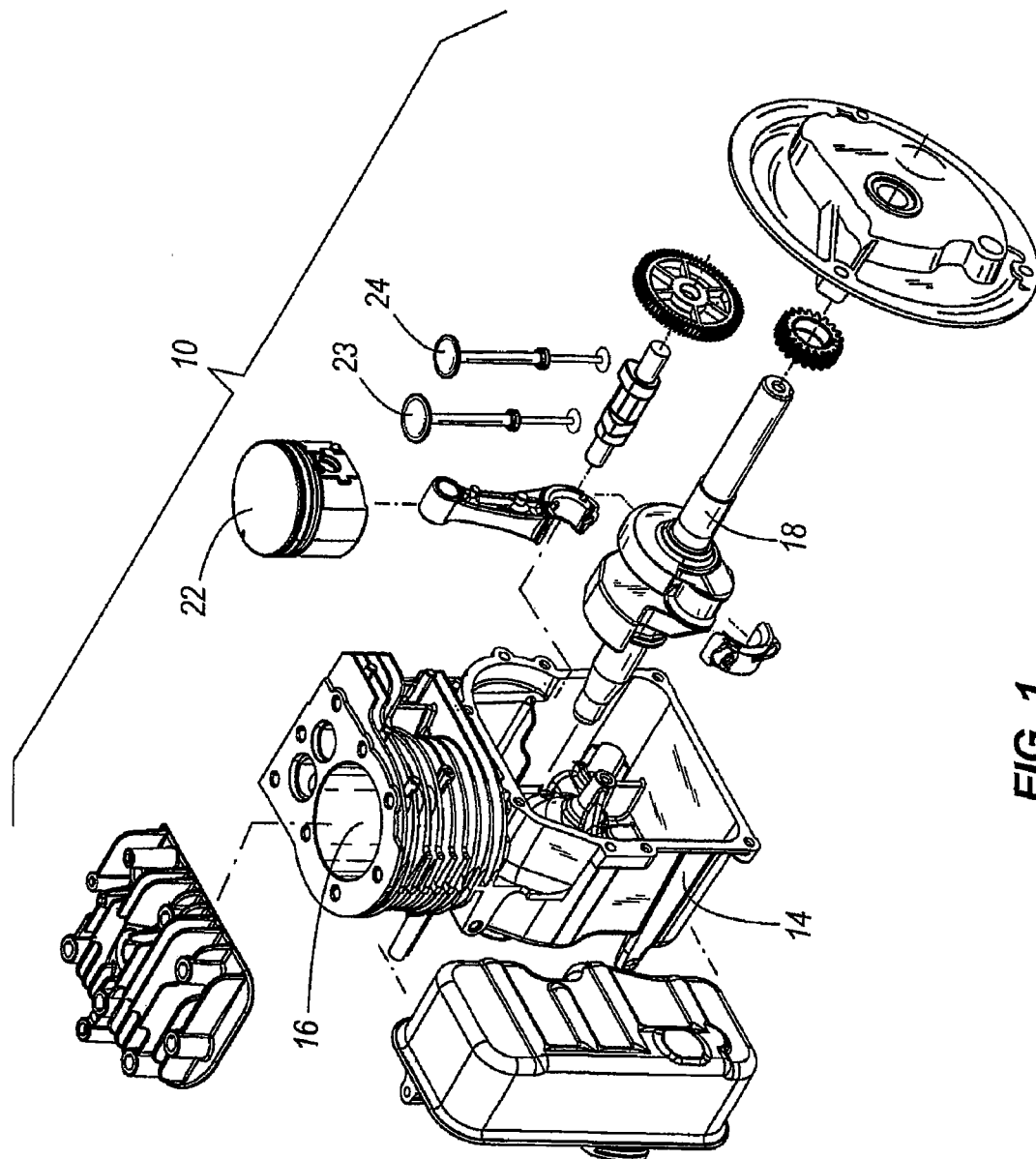
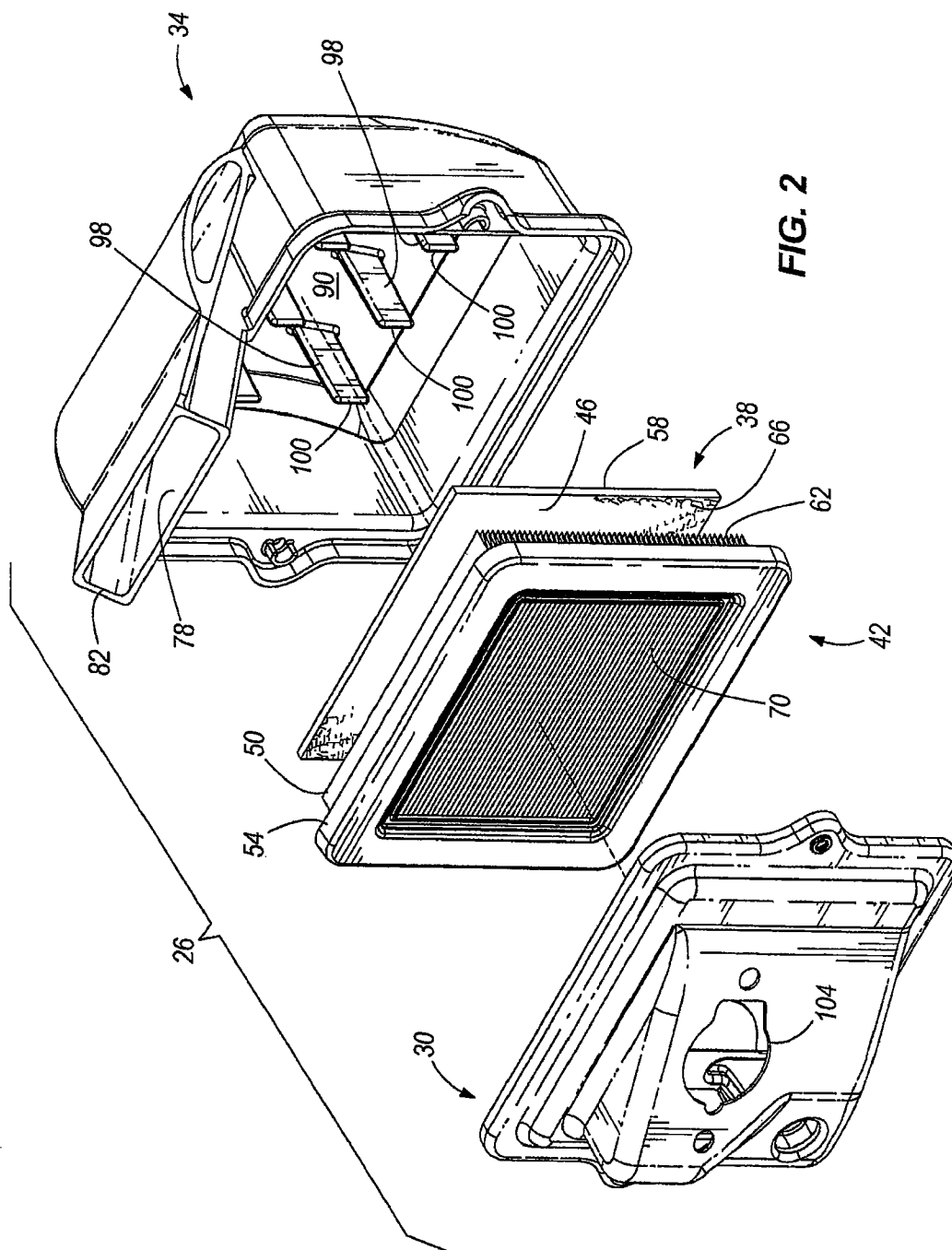


FIG. 1



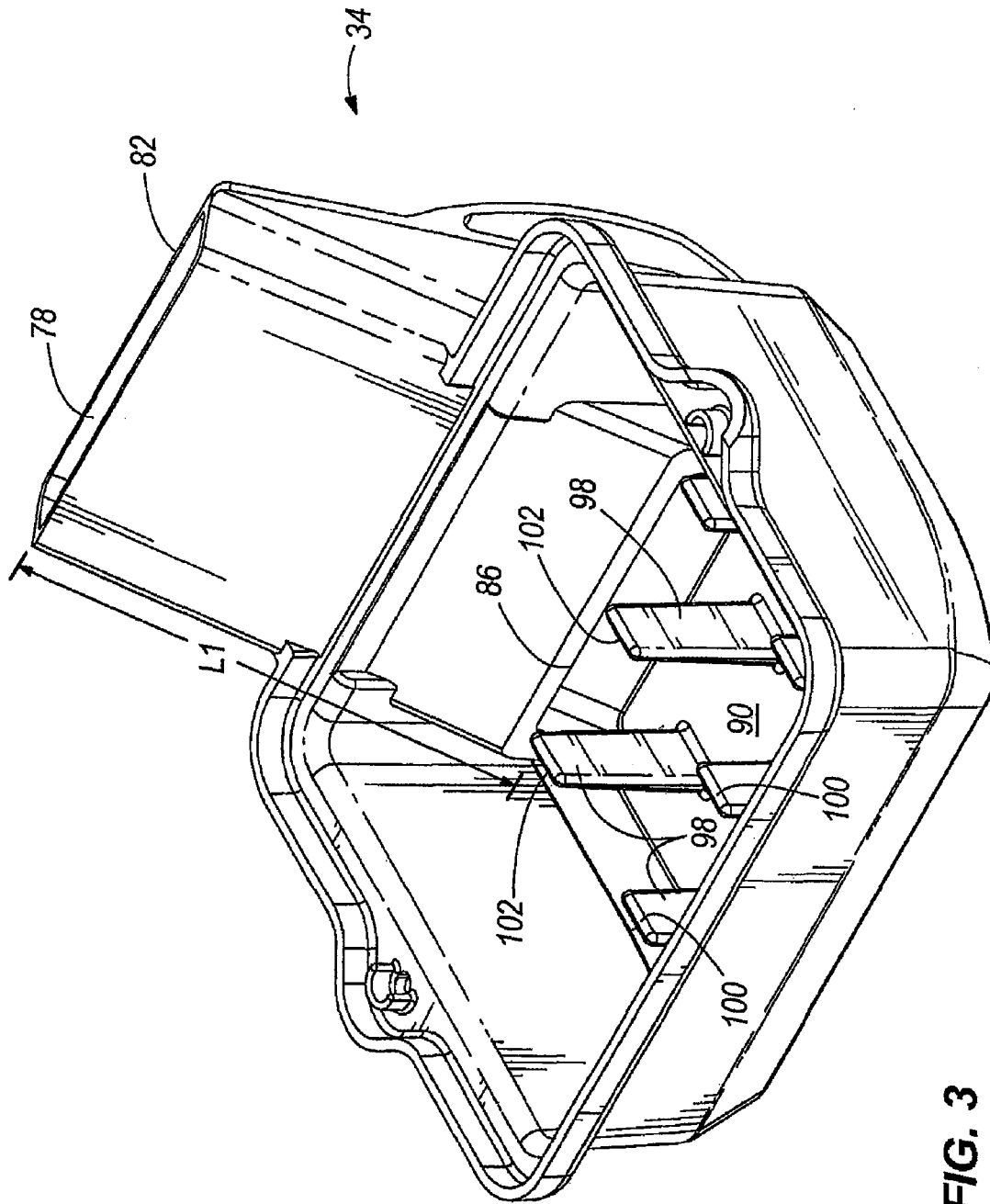


FIG. 3

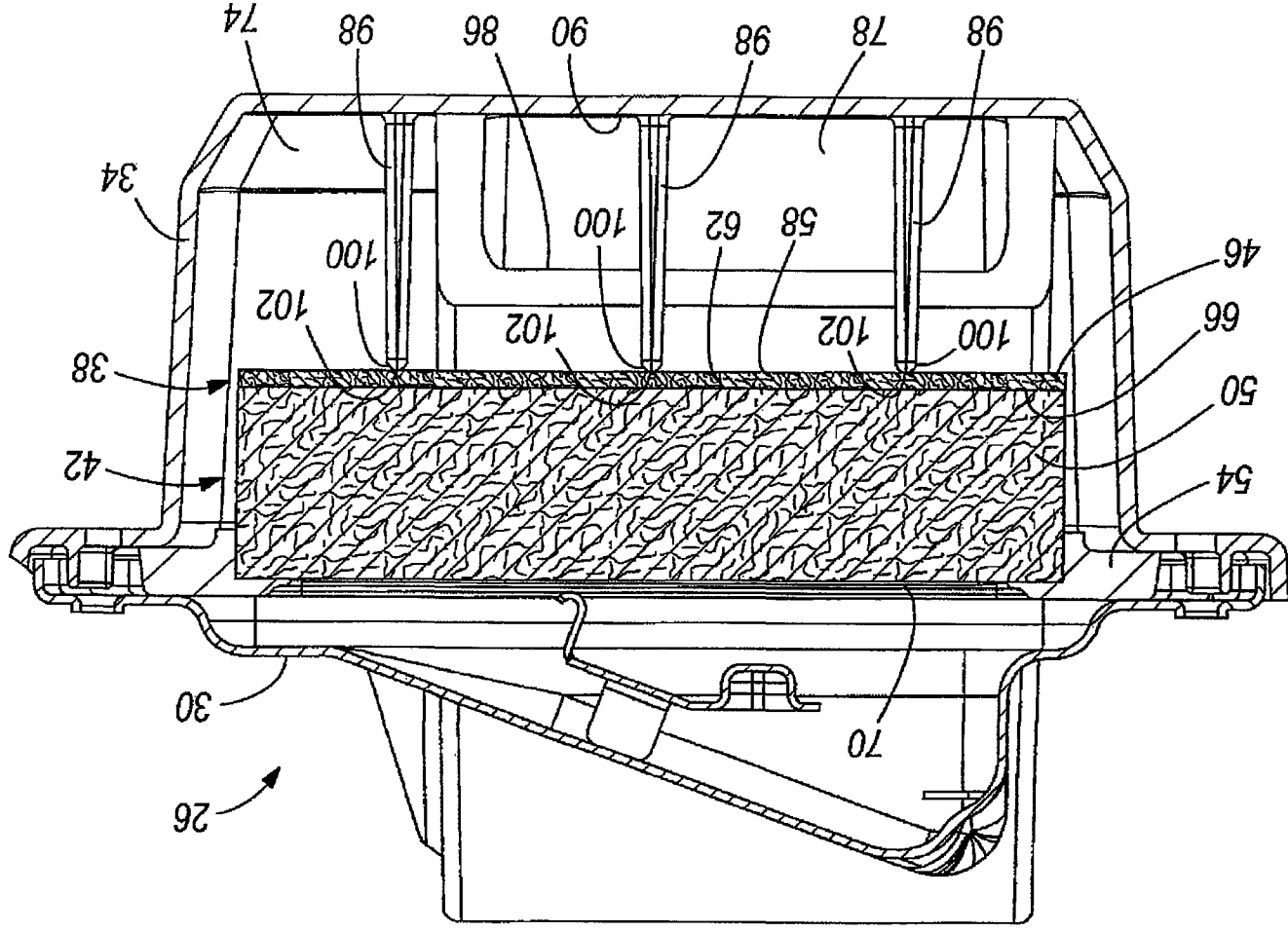
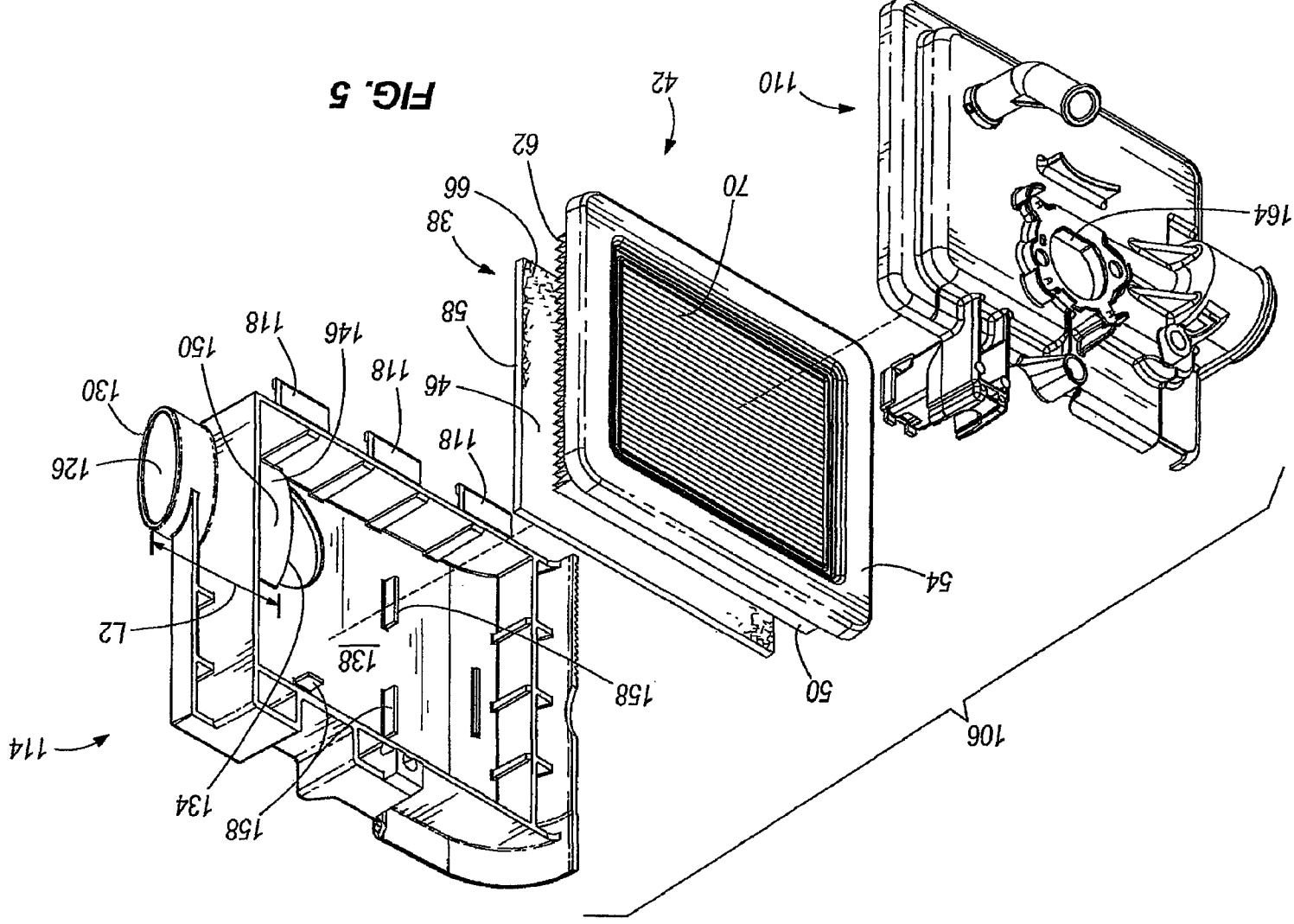


FIG. 4



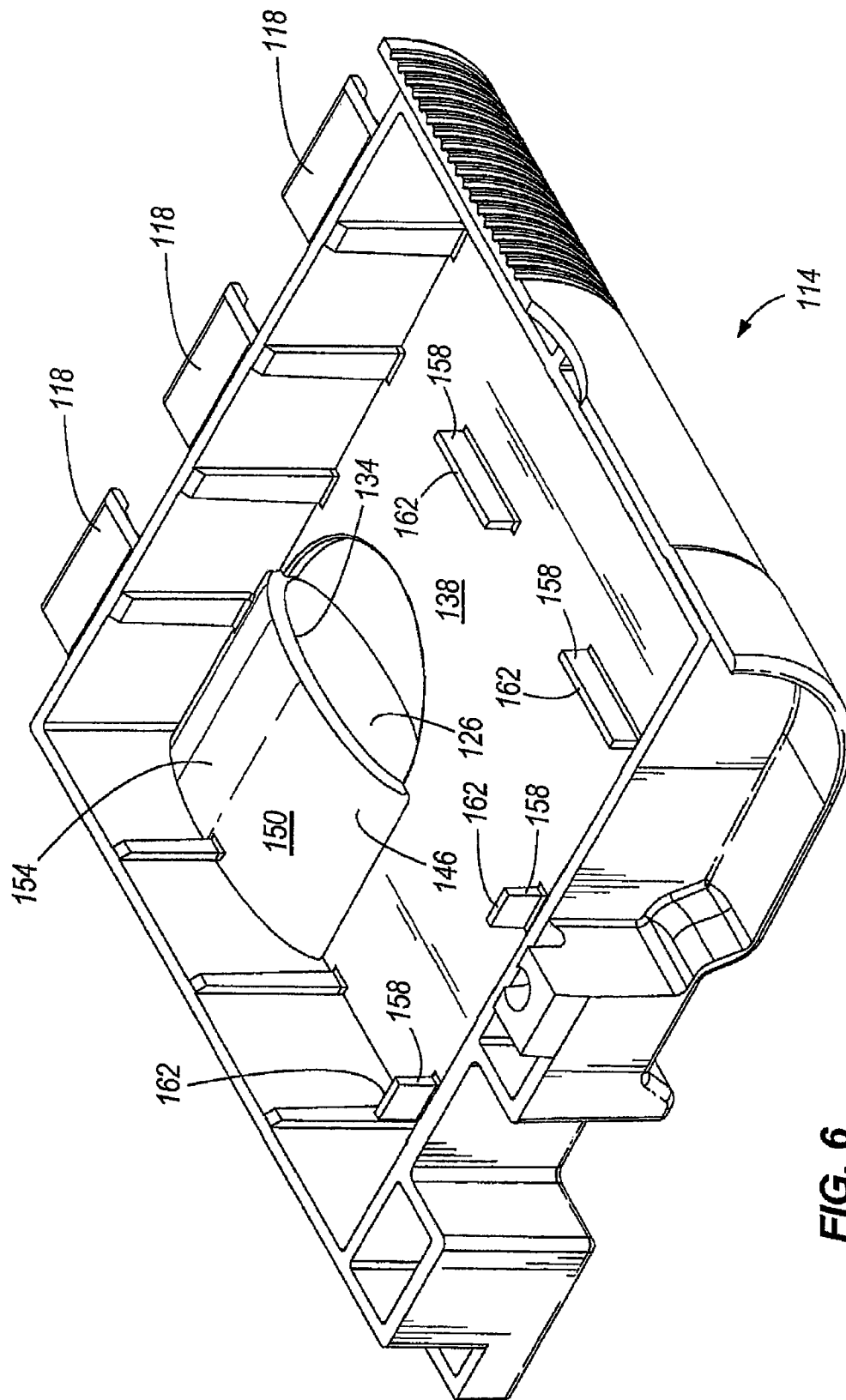


FIG. 6

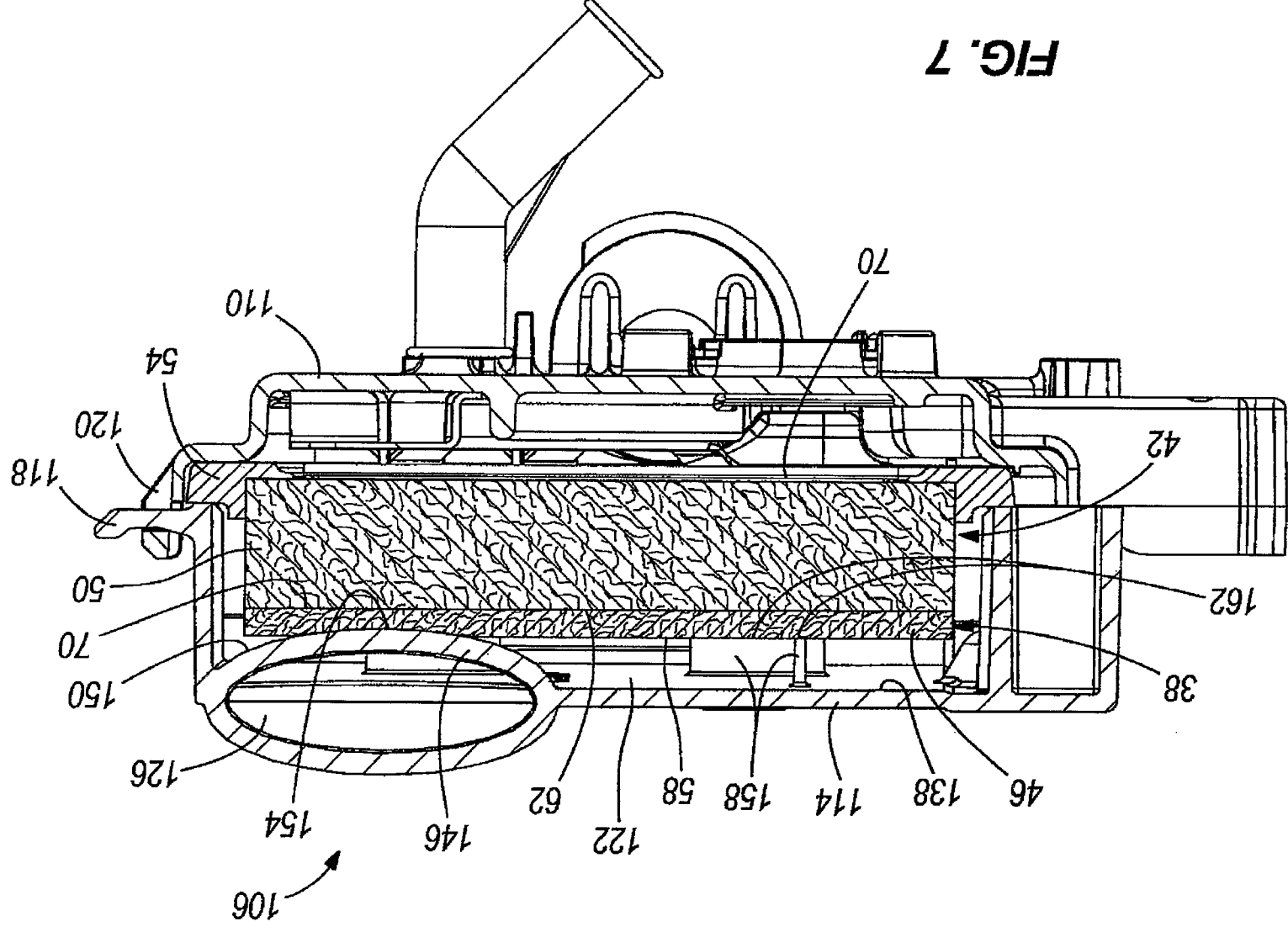


FIG. 7

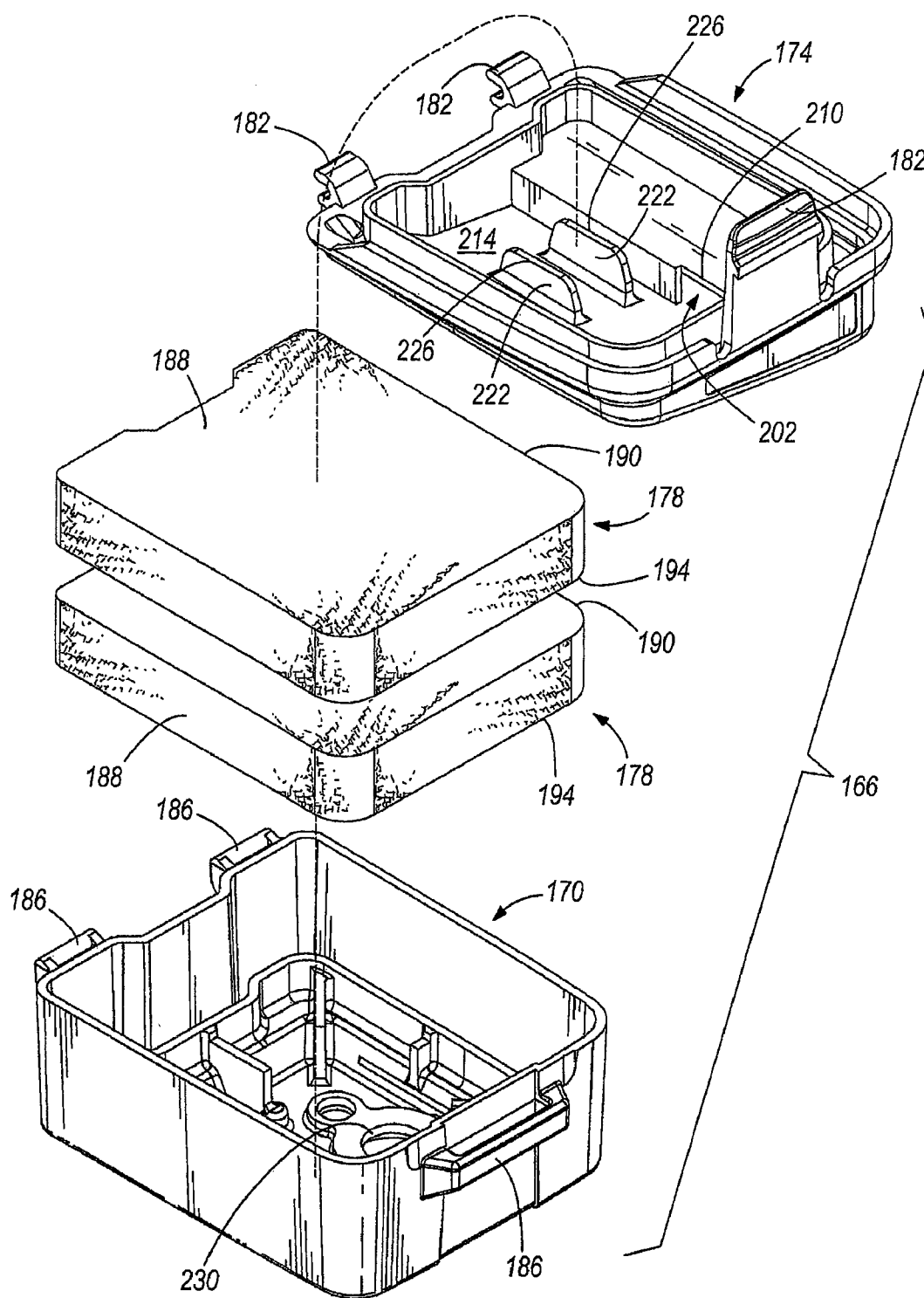


FIG. 8

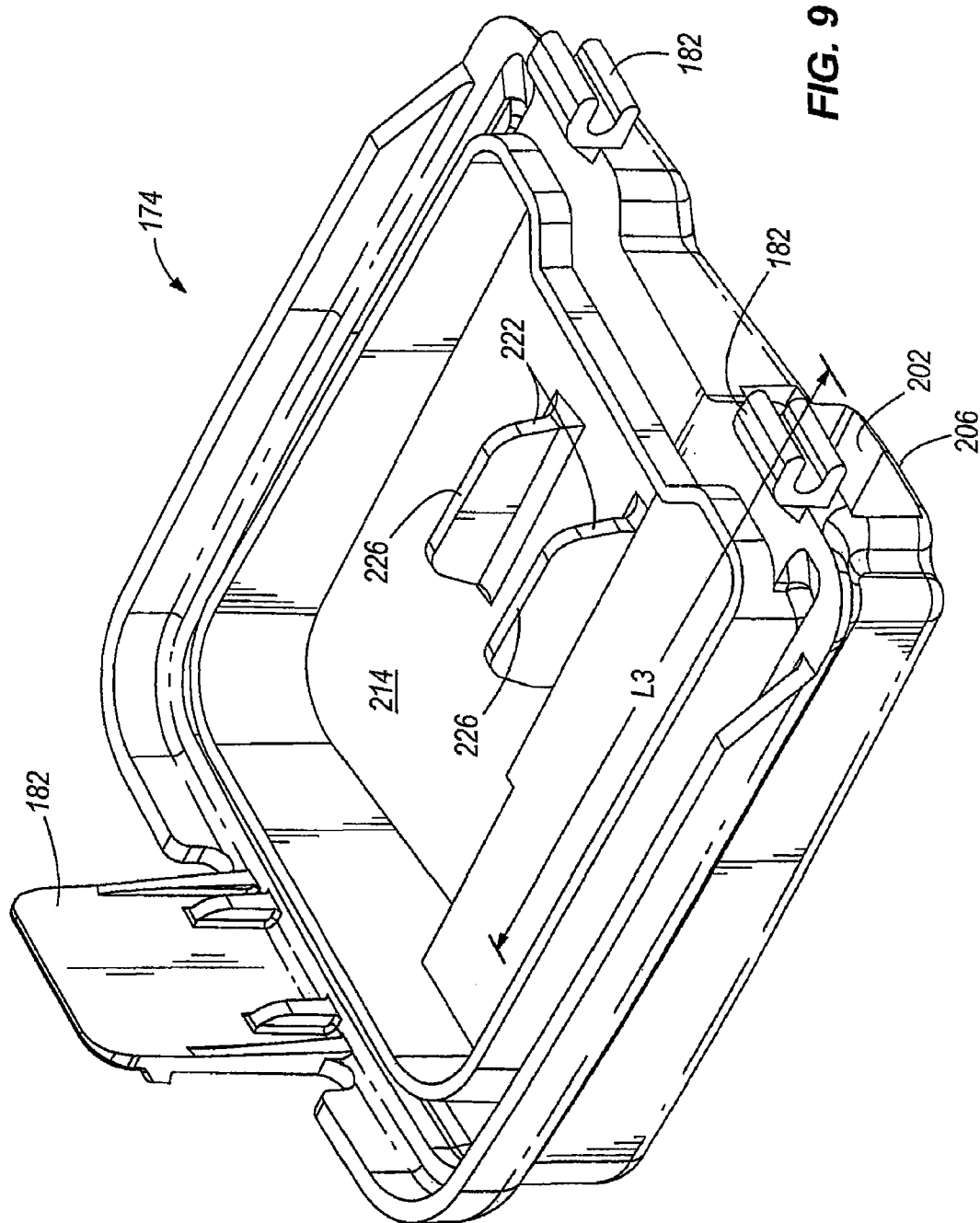
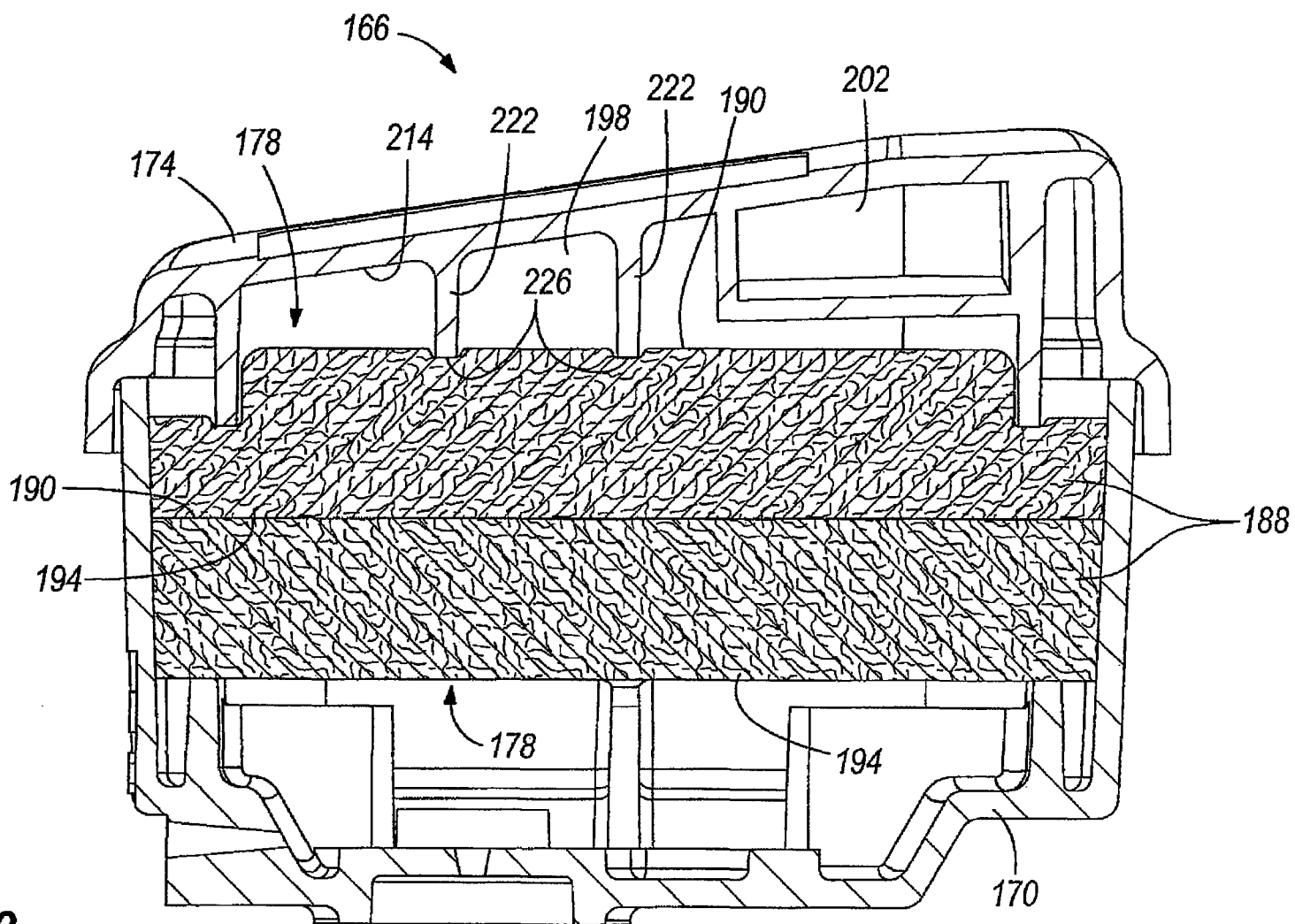


FIG. 9

**FIG. 10**

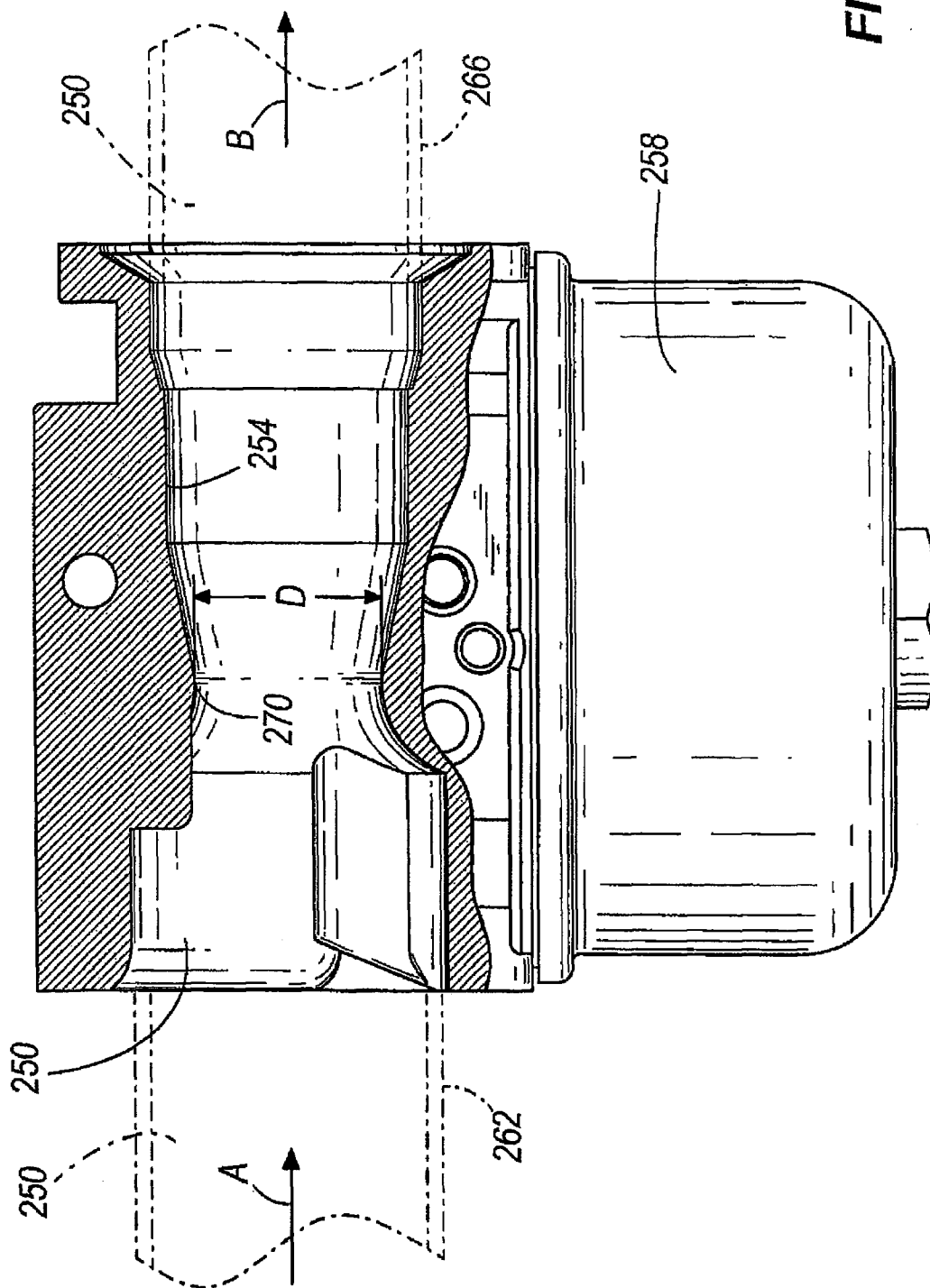


FIG. 11

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FOUR-STROKE INTERNAL COMBUSTION ENGINE HAVING REDUCED NOISE EMISSIONS

FIELD OF THE INVENTION

This invention relates generally to engines, and more particularly to air cleaner assemblies for engines.

BACKGROUND OF THE INVENTION

Small utility engines such as those utilized in walk-behind mowers or pressure washers commonly incorporate an air cleaner assembly for filtering an airflow for use by the engine. Such air cleaner assemblies commonly include a cover, a base, and a filter element positioned between the cover and base. When a cartridge-style filter element is used, the air cleaner assembly commonly includes an air inlet, and an air outlet oriented substantially normal to the air inlet, such that air flowing from the air inlet toward the air outlet passes radially inwardly through the annular filter element before reaching the air outlet. When a flat-panel filter element is used, the air cleaner may include an air inlet, and an air outlet oriented substantially parallel to the air inlet, such that air flowing from the air inlet toward the air outlet passes through the filter element without being significantly redirected.

SUMMARY OF THE INVENTION

The present invention provides a four-stroke internal combustion engine having reduced noise emissions. The engine includes an engine housing including a cylinder, a piston adapted for reciprocating movement in the cylinder, an intake valve selectively movable to allow intake air into the cylinder, and an exhaust valve selectively movable to allow exhaust gases to exit the cylinder. The engine also includes a filter element having a substantially flat inlet side and a substantially flat outlet side, a first housing portion, and a second housing portion coupled to the first housing portion. The first housing portion and second housing portion define an air chamber in which the filter element is supported. The second housing portion includes an interior surface, at least one protrusion extending from the interior surface to space the inlet side of the filter element from the interior surface, and an air passageway including an inlet and an outlet. The outlet is positioned adjacent the interior surface to deliver air to the air chamber between the interior surface and the inlet side of the filter element. The air passageway defines a length dimension and the air chamber defines a volume. A ratio of the volume of the air chamber to the length dimension of the air passageway is between about 5 in² and about 20 in².

Other features and aspects of the invention will become apparent by consideration of the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like reference numerals indicate like parts:

FIG. 1 is an exploded perspective view of a portion of a four-stroke internal combustion engine of the present invention.

FIG. 2 is an exploded perspective view of a first construction of an air cleaner assembly for use with the four-stroke internal combustion engine of the present invention, illustrating filter elements positioned between a cover and a base.

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FIG. 3 is a perspective view of the cover of the air cleaner assembly of FIG. 2, illustrating an interior surface of the cover.

FIG. 4 is an assembled, cross-sectional view of the air cleaner assembly of FIG. 2.

FIG. 5 is an exploded perspective view of a second construction of an air cleaner assembly for use with the four-stroke internal combustion engine of the present invention, illustrating filter elements positioned between a cover and a base.

FIG. 6 is a perspective view of the cover of the air cleaner assembly of FIG. 5, illustrating an interior surface of the cover.

FIG. 7 is an assembled, cross-sectional view of the air cleaner assembly of FIG. 5.

FIG. 8 is an exploded perspective view of a third construction of an air cleaner assembly for use with the four-stroke internal combustion engine of the present invention, illustrating filter elements positioned between a cover and a base.

FIG. 9 is a perspective view of the cover of the air cleaner assembly of FIG. 8, illustrating an interior surface of the cover.

FIG. 10 is an assembled, cross-sectional view of the air cleaner assembly of FIG. 8.

FIG. 11 is a partial cross-sectional view of a portion of an intake passageway of the four-stroke internal combustion engine of FIG. 1.

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings.

DETAILED DESCRIPTION

FIG. 1 illustrates a small, air-cooled, four-stroke internal combustion engine 10. The engine 10 may be configured with a power output as low as about 1 hp and as high as about 35 hp to operate engine-driven outdoor power equipment (e.g., lawn mowers, lawn tractors, snow throwers, pressure washers, weed trimmers, etc.). As shown in FIG. 1, the engine 10 includes a housing 14 having a cylinder 16. A crankshaft 18 is rotatably supported in the housing 14, and a piston 22 is coupled to the crankshaft 18 for reciprocating motion in the cylinder 16. The engine 10 also includes an intake valve 23 that is selectively movable to allow intake air into the cylinder 16, and an exhaust valve 24 that is selectively movable to allow exhaust gases to exit the cylinder 16. Although the engine 10 illustrated in FIG. 1 includes a side-valve configuration, the engine 10 may also include an overhead valve configuration. In addition, although the illustrated engine 10 is configured as a single-cylinder vertical shaft engine 10, the engine 10 may also be configured as a two-cylinder engine or as a horizontal shaft engine.

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FIG. 2 illustrates a first construction of an air cleaner assembly 26 that may be utilized with the engine 10 of FIG. 1 to provide a filtered airflow to the engine 10. With reference to FIG. 2, the air cleaner assembly 26 includes a base 30, a cover 34, a first filter element 38 positioned between the base 30 and the cover 34, and a second filter element 42 positioned between the base 30 and the cover 34. The base 30 may be coupled to the housing 14 by an intake manifold or an intake pipe (not shown) to support the air cleaner assembly 26, and the cover 34 may be coupled to the base 30 using conventional fasteners (not shown) to secure the filter elements 38, 42 between the base 30 and the cover 34.

With continued reference to FIG. 2, the first filter element 38 is configured as a "pre-filter" including an open-cell foam block or sheet 46, while the second filter element 42 is configured as a flat-panel filter element including an air-permeable paper membrane 50 coupled to an elastomeric or rubber base 54. In an alternate configuration, the second filter element 42 may include an open-cell foam block.

The open-cell foam sheet 46 is configured to trap larger-sized particulates and other foreign matter, while the membrane 50 is configured to trap smaller-sized particulates and other foreign matter entrained in an airflow passing through the foam sheet 46 and membrane 50. As shown in FIG. 2, the membrane 50 has a pleated shape to expose a larger total surface area of the membrane 50 to the airflow passing through the membrane 50, as opposed to a substantially flat or planar membrane shape. However, the respective filter elements 46, 50 may generally define substantially planar or flat inlet sides 58, 62 and substantially planar or flat outlet sides 66, 70.

With reference to FIG. 4, the base 30 and cover 34 define an air chamber 74 in which the filter elements 38, 42 are supported. Air is communicated from outside the cover 34 into the air chamber 74 via an air passageway 78 formed in the cover 34 (see also FIGS. 2 and 3). The air passageway 78 includes an air inlet 82 and an air outlet 86 positioned adjacent an interior surface 90 of the cover 34. The cover 34 includes a plurality of protrusions extending from the interior surface 90. The illustrated protrusions are configured as projections 98 upstanding from the interior surface 90. The projections 98 each include a substantially arcuate or curved top edge 100 defining an apex 102.

With reference to FIG. 4, the projections 98 engage the inlet side 58 of the filter element 38 to space the inlet side 58 of the filter element 38 from the interior surface 90 of the cover 34. Particularly, the projections 98 engage the inlet side 58 of the filter element 38 along the respective apices 102 substantially in "line contact." In other words, the respective apices 102 of the projections 98 contact the inlet side 58 of the filter element 38 substantially along a "line," or along a substantially narrow area segment defined on the inlet side 58 of the filter element 38. In alternate constructions of the air cleaner assembly 26 not utilizing the foam sheet 46 as a pre-filter, the projections 98 may contact the inlet side 62 of the filter element 42.

During operation of the engine 10, an airflow is drawn through the air cleaner assembly 26, through the intake manifold, and into the cylinder 16 for combustion. Specifically, the airflow is initially drawn through the air passageway 78 and into the air chamber 74 in a direction substantially parallel with the inlet side 58 of the filter element 38. Since the projections 98 engage the inlet side 58 of the filter element 38 along the respective apices 102 substantially in line contact, the amount of "blocked" area on the inlet side 58 of the filter element 38 that is not exposed to the airflow is reduced. As a result, more of the inlet side 58 of the filter element 38 may be

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exposed to the airflow in the air chamber 74 for filtering, thereby increasing the overall airflow through the filter elements 38, 42 and increasing the usable life of the filter elements 38, 42. Subsequently, downstream of the filter elements 38, 42, the filtered airflow passes through an opening 104 in the base 30 (see FIG. 2) through which the filtered airflow is communicated to the cylinder 16 via the intake manifold or pipe.

FIG. 5 illustrates a second construction of an air cleaner assembly 106. Like the air cleaner assembly 26 of FIGS. 2-4, the air cleaner assembly 106 may be utilized with the engine 10 to provide a filtered airflow to the engine 10. The air cleaner assembly 106 includes a base 110, a cover 114, the first filter element 38 positioned between the base 110 and the cover 114, and the second filter element 42 positioned between the base 110 and the cover 114. As shown in FIG. 5, the filter elements 38, 42 are substantially similar to the filter elements 38, 42 of FIGS. 2-4, and will not be described again in detail. The base 110 may be coupled to the engine housing 14 via an intake manifold or an intake pipe (not shown) to support the air cleaner assembly 106, and the cover 114 may be coupled to the base 110 using a combination of conventional fasteners (not shown) and connecting structure 118, 120 integrally formed with the cover 114 and base 110 to secure the filter elements 38, 42 between the base 110 and the cover 114 (see FIG. 7).

With reference to FIG. 7, the base 110 and cover 114 define an air chamber 122 in which the filter elements 38, 42 are supported. Air is communicated from outside the cover 114 into the air chamber 122 via an air passageway 126 formed in the cover 114 (see FIGS. 5 and 6). The air passageway 126 includes an air inlet 130 and an air outlet 134 positioned adjacent an interior surface 138 of the cover 114. The illustrated air inlet 130 is shaped as an ellipse (see FIG. 5), however, other shapes may be utilized.

With reference to FIGS. 5-7, the cover 114 includes a plurality of protrusions extending from the interior surface 138. At least one of the protrusions is configured as a wall 146 at least partially defining the air passageway 126. The wall 146 includes an arcuate or curved outer surface 150 engaging the inlet side 58 of the filter element 38 to space the inlet side 58 of the filter element 38 from the interior surface 138 of the cover 114. Particularly, the arcuate or curved outer surface 150 of the wall 146 defines an apex 154 along which the inlet side 58 of the filter element 38 is engaged substantially in line contact (see FIG. 7). In other words, like the respective apices 102 of the projections 98 of FIGS. 2-4, the apex 154 of the curved outer surface 150 of the wall 146 contacts the inlet side 58 of the filter element 38 substantially along a "line," or substantially along a substantially narrow area segment defined on the inlet side 58 of the filter element 38.

As shown in FIGS. 5 and 6, other protrusions on the cover 114 are configured as projections 158 upstanding from the interior surface 138 of the cover 114. The projections 158 engage the inlet side 58 of the filter element 38 to space the inlet side 58 of the filter element 38 from the interior surface 138 of the cover 114 (see FIG. 7). Particularly, the projections 158 engage the inlet side 58 of the filter element 38 along respective apices 162 substantially in line contact. Although the respective apices 162 of the projections 158 may not be arcuate or curved, the apices 162 of the projections 158 engage the inlet side 58 of the filter element 38 along a substantially narrow area segment defined on the inlet side 58 of the filter element 38. In alternate constructions of the air cleaner assembly 106 not utilizing the foam sheet 46 as a

pre-filter, the projections 158 and the curved outer surface 150 of the wall 146 may contact the inlet side 62 of the filter element 42.

During operation of the engine 10, an airflow is drawn through the air cleaner assembly 106, through the intake manifold, and into the cylinder 16 for combustion. Specifically, the airflow is initially drawn through the air passageway 126 and into the air chamber 122 in a direction substantially parallel with the inlet side 58 of the filter element 38. Since the curved outer surface 150 of the wall 146 engages the inlet side 58 of the filter element 38 along the apex 154 substantially in line contact, the amount of "blocked" area on the inlet side 58 of the filter element 38 that is not exposed to the airflow is reduced. As a result, more of the inlet side 58 of the filter element 38 may be exposed to the airflow in the air chamber 122 for filtering, thereby increasing the overall airflow through the filter elements 38, 42 and increasing the usable life of the filter elements 38, 42. Subsequently, downstream of the filter elements 38, 42, the filtered airflow passes through an opening 164 in the base 110 (see FIG. 5) through which the filtered airflow is communicated to the cylinder 16 via the intake manifold or pipe.

With reference to FIG. 8, a third construction of an air cleaner assembly 166 is shown. Like the air cleaner assembly 26 of FIGS. 2-4, and the air cleaner assembly 106 of FIGS. 5-7, the air cleaner assembly 166 may be utilized with the engine 10 to provide a filtered airflow to the engine 10. The air cleaner assembly 166 includes a base 170, a cover 174, and dual filter elements 178 positioned between the base 170 and the cover 174. The base 170 may be coupled to the engine housing 14 via the intake manifold or intake pipe (not shown) to support the air cleaner assembly 166, and the cover 174 may be coupled to the base 170 using connecting structure 182, 186 integrally formed with the cover 174 and base 170 to secure the filter elements 178 between the base 170 and the cover 174.

With continued reference to FIG. 8, the illustrated filter elements 178 are configured as open-cell foam blocks 188. Each of the foam blocks 188 generally defines a substantially planar or flat inlet side 190 and a substantially planar or flat outlet side 194. In an alternate configuration, a single thick filter element may be utilized rather than the thinner, dual filter elements 178. In another alternate configuration, at least one of the filter elements 178 may be configured as a flat-panel filter element having an air-permeable paper membrane, like the filter elements 42 of the air cleaner assemblies 26, 106 of FIGS. 2-4 and FIGS. 5-7. In yet another alternate configuration, one of the filter elements 178 may be configured as a thin foam element, or "pre-filter," in combination with the membrane.

With reference to FIG. 10, the base 170 and cover 174 define an air chamber 198 in which the filter elements 178 are supported. Air is communicated from outside the cover 174 into the air chamber 198 via an air passageway 202 formed in the cover 174 (see also FIGS. 8 and 9). The air passageway 202 includes an air inlet 206 and an air outlet 210 positioned adjacent an interior surface 214 of the cover 174. The cover 174 includes a plurality of protrusions extending from the interior surface 214. The protrusions are configured as projections 222 upstanding from the interior surface 214 of the cover 174. The projections 222 engage the inlet side 190 of the adjacent filter element 178 to space the inlet side 190 of the filter element 178 from the interior surface 214 of the cover 174. Particularly, the projections 222 engage the inlet side 190 of the filter element 178 along respective apices 226 substantially in line contact. Although the respective apices 226 of the projections 222 may not be arcuate or curved, the

apices 226 of the projections 222 engage the inlet side 190 of the filter element 178 along a substantially narrow area segment defined on the inlet side 190 of the filter element 178.

During operation of the engine 10, an airflow is drawn through the air cleaner assembly 166 and through the intake manifold for combustion. Specifically, the airflow is initially drawn through the air passageway 202 and into the air chamber 198 in a direction substantially parallel with the inlet side 190 of the filter element 178. Since the projections 222 engage the inlet side 190 of the filter element 178 along the respective apices 226 substantially in line contact, the amount of "blocked" area on the inlet side 190 of the filter element 178 that is not exposed to the airflow is reduced. As a result, more of the inlet side 190 of the filter element 178 may be exposed to the airflow in the air chamber 198 for filtering, thereby increasing the overall airflow through the filter elements 178 and increasing the usable life of the filter elements 178. Subsequently, downstream of the filter elements 178, the filtered airflow passes through an opening 230 in the base 170 (see FIG. 8) through which the filtered airflow is communicated to the cylinder 16 via the intake manifold or pipe.

One or more of the air cleaner assemblies 26, 106, 166 may include air passageways 78, 126, 202 and air chambers 74, 122, 198 sized to reduce the noise emissions of the engine 10. In some embodiments of the air cleaner assemblies 26, 106, 166, the noise emissions of the engine 10 may be reduced by up to about 5 dbA. Particularly, with reference to the air cleaner assembly 26 of FIGS. 2-4, the volume of the air chamber 74 and the length of the air passageway 78 may be sized to attenuate specific frequencies (e.g., between about 300 Hz and about 700 Hz) associated with intake airflow noise in the air cleaner assembly 26. In one embodiment of the air cleaner assembly 26, the air passageway 78 may include a length dimension L1 (see FIG. 3), such that a ratio of the volume of the air chamber 74 to the length dimension L1 is between about 5 in² and about 20 in² to attenuate frequencies between about 300 Hz and about 700 Hz associated with intake airflow noise. Particularly, in the illustrated construction of the air cleaner assembly 26, the ratio of the volume of the air chamber 74 to the length dimension L1 is about 13 in².

Likewise, with reference to the air cleaner assembly 106 of FIGS. 5-7, the volume of the air chamber 122 and the length of the air passageway 126 may be sized to attenuate specific frequencies (e.g., between about 300 Hz and about 700 Hz) associated with intake airflow noise in the air cleaner assembly 106. In one embodiment of the air cleaner assembly 106, the air passageway 126 may include a length dimension L2 (see FIG. 5), such that a ratio of the volume of the air chamber 122 to the length dimension L2 is between about 5 in² and about 20 in² to attenuate frequencies between about 300 Hz and about 700 Hz associated with intake airflow noise. Particularly, in the illustrated construction of the air cleaner assembly 106, the ratio of the volume of the air chamber 122 to the length dimension L2 is about 13 in².

Further, with reference to the air cleaner assembly 166 of FIGS. 8-10, the volume of the air chamber 198 and the length of the air passageway 202 may be sized to attenuate specific frequencies (e.g., between about 300 Hz and about 700 Hz) associated with intake airflow noise in the air cleaner assembly 166. In one embodiment of the air cleaner assembly 166, the air passageway 202 may include an average length dimension L3 (see FIG. 9), such that a ratio of the volume of the air chamber 198 to the length dimension L3 is between about 5 in² and about 20 in² to attenuate frequencies between about 300 Hz and about 700 Hz associated with intake airflow noise. Particularly, in the illustrated construction of the air cleaner

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assembly 166, the ratio of the volume of the air chamber 198 to the length dimension L3 is about 6 in².

One or more of the air cleaner assemblies 26, 106, 166 may also include air passageways 78, 126, 202 sized with respect to an intake passageway 250 in the engine 10 so as to not restrict the flow of air or the flow of an air/fuel mixture through the intake passageway 250. FIG. 11 illustrates a portion of the intake passageway 250 through the engine 10. Specifically, the illustrated portion of the intake passageway 250 includes a venturi 254 formed in a carburetor 258, a conduit 262 directing an airflow (indicated by arrow "A") toward the venturi 254, and a conduit 266 directing an air/fuel mixture (indicated by arrow "B") away from the venturi 254. The conduit 262 may extend between any of the air cleaner assemblies 26, 106, 166 and the inlet of the venturi 254, while the conduit 266 may comprise an intake manifold or pipe extending between the outlet of the venturi 254 and an intake port (not shown) in the engine housing 14.

With continued reference to FIG. 11, the intake passageway 250 includes a restriction 270, having a diameter "D," formed in the venturi 254. The restriction 270 limits the amount of airflow or air/fuel mixture that the intake passageway 250 is capable of delivering to the intake port of the engine 10. The restriction 270 defines a cross-sectional area, proportional to diameter D, in a plane substantially normal to the direction of airflow (indicated by arrow A) through the venturi 254. With reference to FIG. 3, the air passageway 78 may define a cross-sectional area, in a plane substantially normal to the length dimension L1, at least twice as large as the cross-sectional area of the restriction 270 in the intake passageway 250. Likewise, with reference to FIG. 5, the air passageway 126 may define a cross-sectional area, in a plane substantially normal to the length dimension L2, at least twice as large as the cross-sectional area of the restriction 270 in the intake passageway 250. Further, with reference to FIG. 9, the air passageway 202 may define a cross-sectional area, in a plane substantially normal to the length dimension L3, at least twice as large as the cross-sectional area of the restriction 270 in the intake passageway 250.

In an alternative construction of the intake passageway 250 of the engine 10, the restriction 270 may be formed within a different portion of the intake passageway 250. For example, in a configuration of the engine 10 utilizing fuel injection, the restriction 270 may be formed within a throttle body.

Various features of the invention are set forth in the following claims.

What is claimed is:

1. A four-stroke internal combustion engine having reduced noise emissions, the engine comprising:
 - an engine housing including a cylinder;
 - a piston adapted for reciprocating movement in the cylinder;

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an intake valve selectively movable to allow intake air into the cylinder;

an exhaust valve selectively movable to allow exhaust gases to exit the cylinder;

a filter element having

a substantially flat inlet side;

a substantially flat outlet side;

a first housing portion;

a second housing portion coupled to the first housing portion, the first housing portion and second housing portion defining an air chamber in which the filter element is supported, the second housing portion including an interior surface;

at least one protrusion extending from the interior surface to space the inlet side of the filter element from the interior surface; and

an air passageway including an inlet and an outlet, the outlet positioned adjacent the interior surface to deliver air to the air chamber between the interior surface and the inlet side of the filter element;

wherein the at least one protrusion includes a wall at least partially defining the air passageway, and wherein the wall includes a curved outer surface having an apex that engages the inlet side of the filter element substantially in line contact.

2. The engine of claim 1, wherein the at least one protrusion further includes a plurality of projections extending from the interior surface to engage the inlet side of the filter element substantially in line contact.

3. The engine of claim 1, wherein the at least one protrusion is integrally formed with the second housing portion.

4. The engine of claim 1, wherein the air enters the air chamber in a direction parallel to the inlet side of the filter element.

5. The engine of claim 1, wherein the inlet of the air passageway is shaped as an ellipse.

6. The engine of claim 1, wherein the filter element is a first filter element, and wherein the engine further includes a second filter element positioned adjacent the first filter element.

7. The engine of claim 6, wherein at least one of the first and second filter elements includes an open-cell foam pre-filter.

8. The engine of claim 1, further comprising an intake passageway extending between the first housing portion and the engine housing, wherein the intake passageway includes a restriction having a cross-sectional area in a plane normal to the direction of fluid flow through the intake passageway, and wherein the air passageway has a cross-sectional area in a plane normal to a length dimension of the air passageway that is at least twice as large as the cross-sectional area of the restriction.

* * * * *



US00D540928S

(12) **United States Design Patent** (10) Patent No.: **US D540,928 S**
Matel et al. (45) Date of Patent: **** Apr. 17, 2007**

(54) **AIR CLEANER COVER**

(75) Inventors: **Elliot Matel**, Milwaukee, WI (US);
Marvin Vissers, Oak Creek, WI (US);
Jeffrey H. Whitmore, Shorewood, WI (US)

(73) Assignee: **Briggs & Stratton Corporation**,
Wauwatosa, WI (US)

(**) Term: **14 Years**

(21) Appl. No.: **29/236,100**

(22) Filed: **Aug. 11, 2005**

(51) **LOC (8) Cl.** **23-04**

(52) **U.S. Cl.** **D23/364; D15/5**

(58) **Field of Classification Search** **D23/355,**
D23/364-5; 55/385.3, DIG. 17; 96/388; D15/5
See application file for complete search history.

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(Continued)

Primary Examiner—Robin Webster

(74) Attorney, Agent, or Firm—Michael Best & Friedrich LLP

(57) **CLAIM**

The ornamental design for an air cleaner cover, as shown and described.

DESCRIPTION

FIG. 1 is a front perspective view of an air cleaner cover of the present invention.

FIG. 2 is a front view of the air cleaner cover of FIG. 1.

FIG. 3 is a rear view of the air cleaner cover of FIG. 1.

FIG. 4 is a top view of the air cleaner cover of FIG. 1.

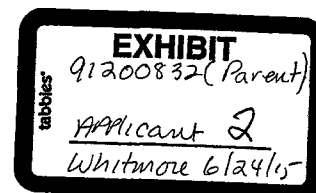
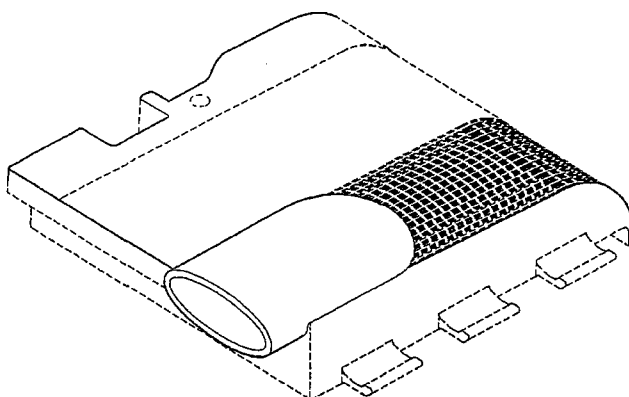
FIG. 5 is a bottom view of the air cleaner cover of FIG. 1.

FIG. 6 is a left side view of the air cleaner cover of FIG. 1; and,

FIG. 7 is a right side view of the air cleaner cover of FIG. 1.

The broken line showing of the environment is for illustrative purposes only and forms no part of the claimed design. The broken lines which define portions of the air cleaner cover of the claimed design form no part thereof.

1 Claim, 5 Drawing Sheets



OTHER PUBLICATIONS

Briggs & Stratton Illustrated Parts List Model Series 129700, pp. 4, 13, and 14, Dec. 14, 2005.

Figs. 1-3 illustrate an air cleaner from a Honda Model EU1000i generator commercially available at least as early as 2001.

Figs. 4-6 illustrate an air cleaner from a Honda Model EU2000i generator commercially available at least as early as 2001.

Figs. 7-9 illustrate an air cleaner from a Yanmar Model GA180 engine commercially available at least as early as 2005.

Figs. 10-11 illustrate an air cleaner from a Tecumseh engine commercially available at least as early as 1979.

Figs. 12-13 illustrate an air cleaner from a Mitsubishi Heavy Industries Model No. 245432 engine commercially available at least as early as May 18, 2005.

Figs. 14-15 illustrate an air cleaner cover from a Briggs & Stratton Model 13 engine commercially available at least as early as Aug. 14, 1992.

Figs. 16-17 illustrate an air cleaner cover from a Briggs & Stratton Model 9U and Model 11U engine commercially available at least as early as Nov. 1, 1983.

* cited by examiner

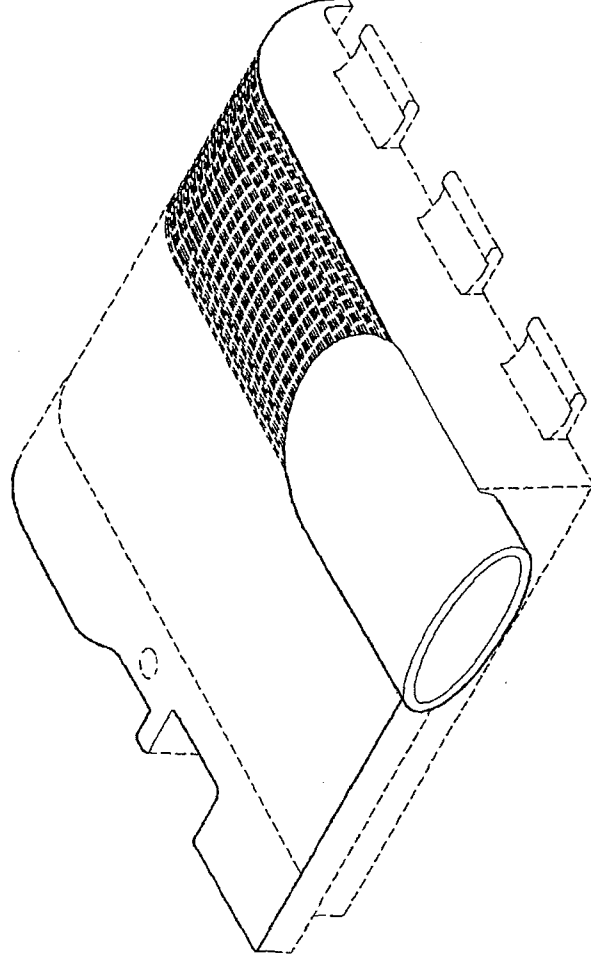


FIG. 1

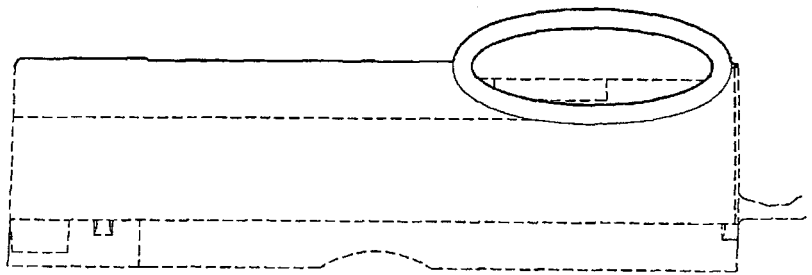


FIG. 2

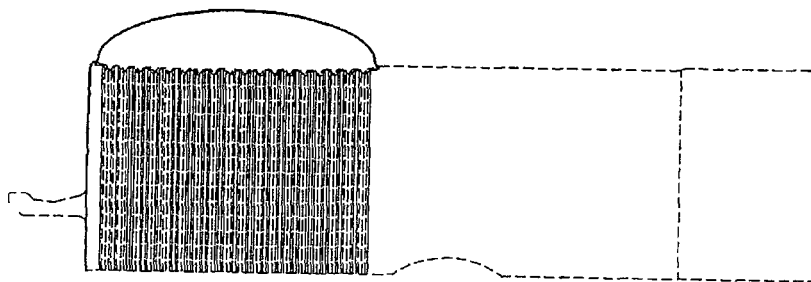


FIG. 3

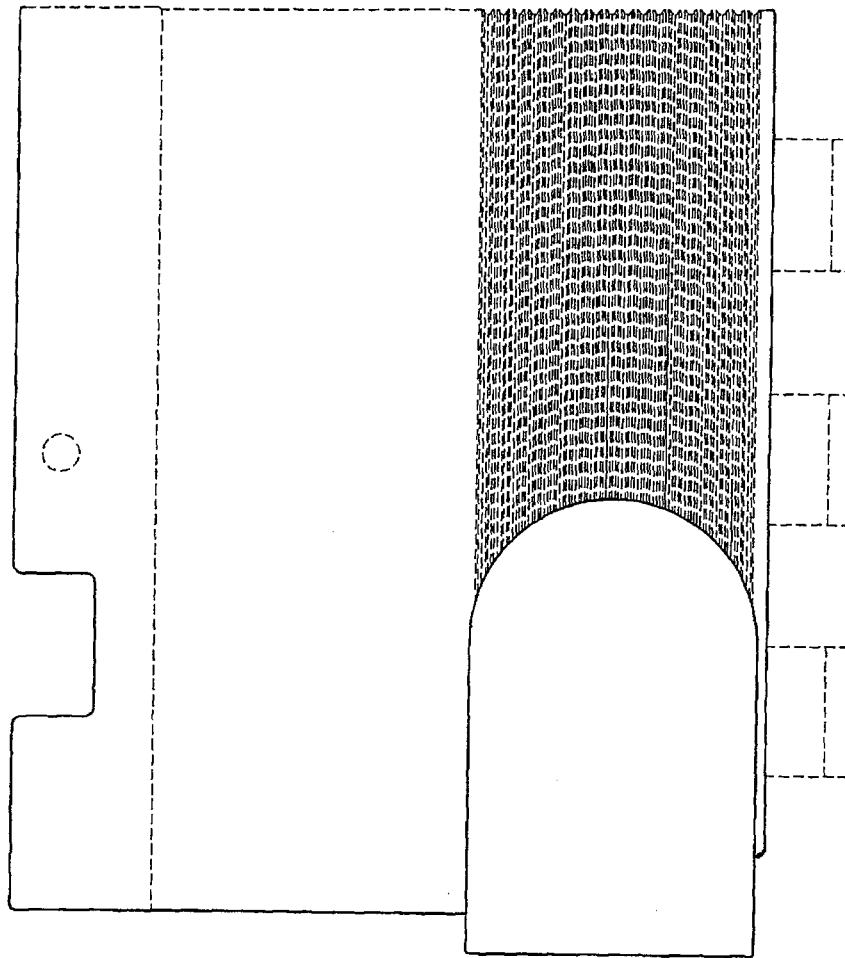


FIG. 4

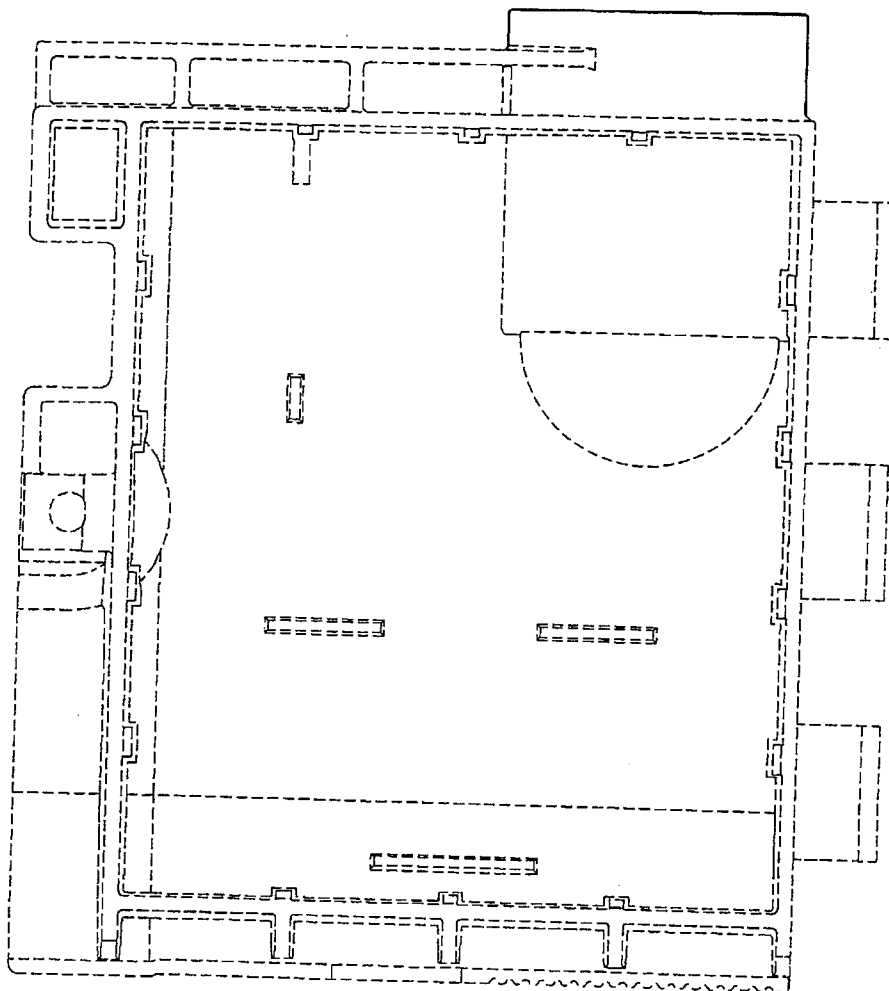


FIG. 5

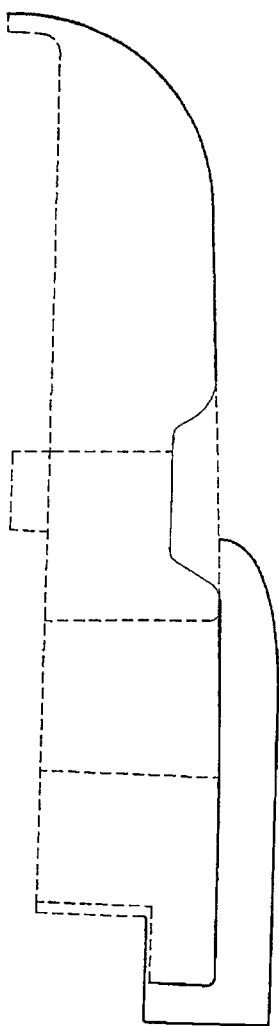


FIG. 6

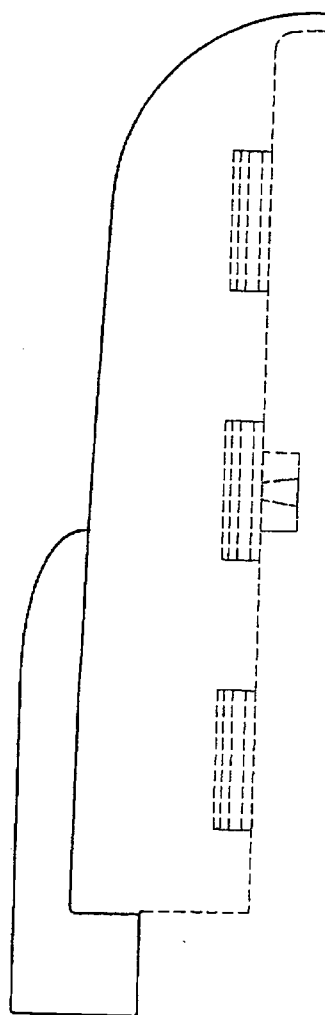


FIG. 7

Opposers' Trial Exhibit No. 3

(June 24, 2015 Deposition of Jeff Whitmore)

CONFIDENTIAL

ATTORNEYS' EYES ONLY

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Applicant's Trial Exhibit No. 4

(June 24, 2015 Deposition of Jeff Whitmore)

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Applicant's Trial Exhibit No. 5

(June 24, 2015 Deposition of Jeff Whitmore)

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From: TMOOfficialNotices@USPTO.GOV
Sent: Tuesday, January 25, 2011 00:25 AM
To: michael.bevilacqua@wilmerhale.com
Subject: Official USPTO Notice of Publication: Serial Number 78924545

NOTICE OF PUBLICATION

Serial Number: 78-924,545
Mark: Miscellaneous Design
International Class(es): 007
Applicant: Honda Giken Kogyo Kabushiki Kaisha (Honda Motor Co., Ltd.)
Attorney Reference Number: 103.443.241

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4. Enter in the "search" box the name of the applicant (for individual: last name, first name) or the serial number in this exact format (with hyphen and comma): 78-924,545, e.g.
5. View the retrieved result(s). If multiple results appear in the "results" box, click directly on each "search term" shown in the box to access all separate appearances in the OG.



Trademark Snap Shot Publication & Issue Review Stylesheet
(Table presents the data on Publication & Issue Review Complete)

OVERVIEW

SERIAL NUMBER	78924545	FILING DATE	07/07/2006
REG NUMBER	0000000	REG DATE	N/A
REGISTER	PRINCIPAL	MARK TYPE	TRADEMARK
INTL REG #	N/A	INTL REG DATE	N/A
TM ATTORNEY	RAUEN, JAMES A	L.O. ASSIGNED	109

PUB INFORMATION

RUN DATE	11/30/2010
PUB DATE	01/04/2011
STATUS	681-PUBLICATION/ISSUE REVIEW COMPLETE
STATUS DATE	11/27/2010
LITERAL MARK ELEMENT	

DATE ABANDONED	N/A	DATE CANCELLED	N/A
SECTION 2F	YES	SECTION 2F IN PART	NO
SECTION 8	NO	SECTION 8 IN PART	NO
SECTION 15	NO	REPUB 12C	N/A
RENEWAL FILED	NO	RENEWAL DATE	N/A
DATE AMEND REG	N/A		

FILING BASIS

FILED BASIS		CURRENT BASIS		AMENDED BASIS	
1 (a)	YES	1 (a)	YES	1 (a)	NO
1 (b)	NO	1 (b)	NO	1 (b)	NO
44D	NO	44D	NO	44D	NO
44E	NO	44E	NO	44E	NO
66A	NO	66A	NO		
NO BASIS	NO	NO BASIS	NO		

MARK DATA

STANDARD CHARACTER MARK	NO
LITERAL MARK ELEMENT	

MARK DRAWING CODE	2-AN ILLUSTRATION DRAWING WITHOUT ANY WORD(S)/LETTER(S)/NUMBER(S)
COLOR DRAWING FLAG	NO

CURRENT OWNER INFORMATION

PARTY TYPE	20-OWNER AT PUBLICATION
NAME	Honda Giken Kogyo Kabushiki Kaisha (Honda Motor Co., Ltd.)
ADDRESS	No. 1-1, 2-Chome, Minamiaoyama Minato-Ku, Tokyo, 107-8556
ENTITY	03-CORPORATION
CITIZENSHIP	Japan

GOODS AND SERVICES

INTERNATIONAL CLASS	007
DESCRIPTION TEXT	engines for use in construction, maintenance and power equipment

GOODS AND SERVICES CLASSIFICATION

INTERNATIONAL CLASS	007	FIRST USE DATE	10/00/1983	FIRST USE IN COMMERCE DATE	12/00/1984	CLASS STATUS	6-ACTIVE
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MISCELLANEOUS INFORMATION/STATEMENTS

CHANGE IN REGISTRATION	NO
COLORS CLAIMED STATEMENT	Color is not claimed as a feature of the mark.
DISCLAIMER W/PREDETER TXT	THE DESIGN MARK'S PURELY FUNCTIONAL COMPONENTS, NAMELY LEVERS, BOLTS, NUTS AND CAPS
DESCRIPTION OF MARK	The mark consists of the configuration of an engine with an overall cubic design, with a slanted fan cover, the fuel tank located above the fan cover on the right, and the air cleaner located to the left of the fuel tank. The air cleaner cover features a cube shape with beveled top outside edges, and a belt-like area on the lower portion of the cover encompassing the entire circumference and the top of the belt-like area is aligned with a rib of the fuel tank. The carburetor cover features four ribs along its outside edge and a recessed area where control levers are located. The fuel tank is roughly rectangular. The engine features a beveling that runs around its top circumference.
LINING & STIPPLING STMT	The broken lining in the drawing is not part of the mark and serves only to indicate position.

PROSECUTION HISTORY

DATE	ENT CD	ENT TYPE	DESCRIPTION	ENT NUM
11/27/2010	PREV	O	LAW OFFICE PUBLICATION REVIEW COMPLETED	059
11/12/2010	CNSA	O	APPROVED FOR PUB - PRINCIPAL REGISTER	058
10/22/2010	TEME	I	TEAS/EMAIL CORRESPONDENCE ENTERED	057
10/22/2010	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	056
10/20/2010	ERFR	I	TEAS REQUEST FOR RECONSIDERATION RECEIVED	055
08/26/2010	GNFN	O	NOTIFICATION OF FINAL REFUSAL EMAILED	054
08/26/2010	GNFR	O	FINAL REFUSAL E-MAILED	053
08/26/2010	CNFR	R	FINAL REFUSAL WRITTEN	052
08/06/2010	TEME	I	TEAS/EMAIL CORRESPONDENCE ENTERED	051
08/06/2010	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	050
08/04/2010	TROA	I	TEAS RESPONSE TO OFFICE ACTION RECEIVED	049
02/05/2010	GNRN	O	NOTIFICATION OF NON-FINAL ACTION E-MAILED	048
02/05/2010	GNRT	O	NON-FINAL ACTION E-MAILED	047
02/05/2010	CNRT	R	NON-FINAL ACTION WRITTEN	046
01/28/2010	ZZZX	Z	PREVIOUS ALLOWANCE COUNT WITHDRAWN	045
11/10/2009	PBSR	Z	WITHDRAWN FROM PUB - SENIOR ATTORNEY REQUEST	044
11/02/2009	PREV	O	LAW OFFICE PUBLICATION REVIEW COMPLETED	043
10/28/2009	CNSA	O	APPROVED FOR PUB - PRINCIPAL REGISTER	042
10/26/2009	TEME	I	TEAS/EMAIL CORRESPONDENCE ENTERED	041
10/26/2009	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	040
10/26/2009	TROA	I	TEAS RESPONSE TO OFFICE ACTION RECEIVED	039
04/27/2009	GNRN	O	NOTIFICATION OF NON-FINAL ACTION E-MAILED	038
04/27/2009	GNRT	O	NON-FINAL ACTION E-MAILED	037
04/27/2009	CNRT	R	NON-FINAL ACTION WRITTEN	036
03/07/2009	TEME	I	TEAS/EMAIL CORRESPONDENCE ENTERED	035
03/07/2009	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	034
03/04/2009	MAIL	I	PAPER RECEIVED	033
10/29/2008	OP.I	T	OPPOSITION INSTITUTED NO. 999999	032
09/02/2008	GNRN	O	NOTIFICATION OF NON-FINAL ACTION E-MAILED	031
09/02/2008	GNRT	O	NON-FINAL ACTION E-MAILED	030
09/02/2008	CNRT	R	NON-FINAL ACTION WRITTEN	029
08/18/2008	ZZZX	Z	PREVIOUS ALLOWANCE COUNT WITHDRAWN	028
07/30/2008	LOPT	I	LETTER OF PROTEST ACCEPTED	027

04/17/2008	ETOF	T	EXTENSION OF TIME TO OPPOSE RECEIVED	026
03/25/2008	PUBO	A	PUBLISHED FOR OPPOSITION	025
03/05/2008	NPUB	O	NOTICE OF PUBLICATION	024
02/19/2008	PREV	O	LAW OFFICE PUBLICATION REVIEW COMPLETED	023
02/13/2008	CNSA	O	APPROVED FOR PUB - PRINCIPAL REGISTER	022
02/11/2008	TEME	I	TEAS/EMAIL CORRESPONDENCE ENTERED	021
02/11/2008	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	020
02/11/2008	TROA	I	TEAS RESPONSE TO OFFICE ACTION RECEIVED	019
08/15/2007	GNRN	O	NOTIFICATION OF NON-FINAL ACTION E-MAILED	018
08/15/2007	GNRT	O	NON-FINAL ACTION E-MAILED	017
08/15/2007	CNRT	R	NON-FINAL ACTION WRITTEN	016
08/12/2007	ZZZX	Z	PREVIOUS ALLOWANCE COUNT WITHDRAWN	015
07/23/2007	PBCR	Z	WITHDRAWN FROM PUB - OG REVIEW QUERY	014
07/06/2007	PREV	O	LAW OFFICE PUBLICATION REVIEW COMPLETED	013
06/28/2007	CNSA	O	APPROVED FOR PUB - PRINCIPAL REGISTER	012
06/22/2007	ACEC	I	AMENDMENT FROM APPLICANT ENTERED	011
06/22/2007	CRFA	I	CORRESPONDENCE RECEIVED IN LAW OFFICE	010
06/22/2007	ALIE	A	ASSIGNED TO LIE	009
06/11/2007	MAIL	I	PAPER RECEIVED	008
02/21/2007	CHAN	I	APPLICANT/CORRESPONDENCE CHANGES (NON-RESPONSIVE) ENTERED	007
02/21/2007	COAR	I	TEAS CHANGE OF OWNER ADDRESS RECEIVED	006
12/08/2006	GNRT	F	NON-FINAL ACTION E-MAILED	005
12/08/2006	CNRT	R	NON-FINAL ACTION WRITTEN	004
12/07/2006	DOCK	D	ASSIGNED TO EXAMINER	003
07/13/2006	MDSC	O	NOTICE OF DESIGN SEARCH CODE MAILED	002
07/12/2006	NWAP	I	NEW APPLICATION ENTERED IN TRAM	001

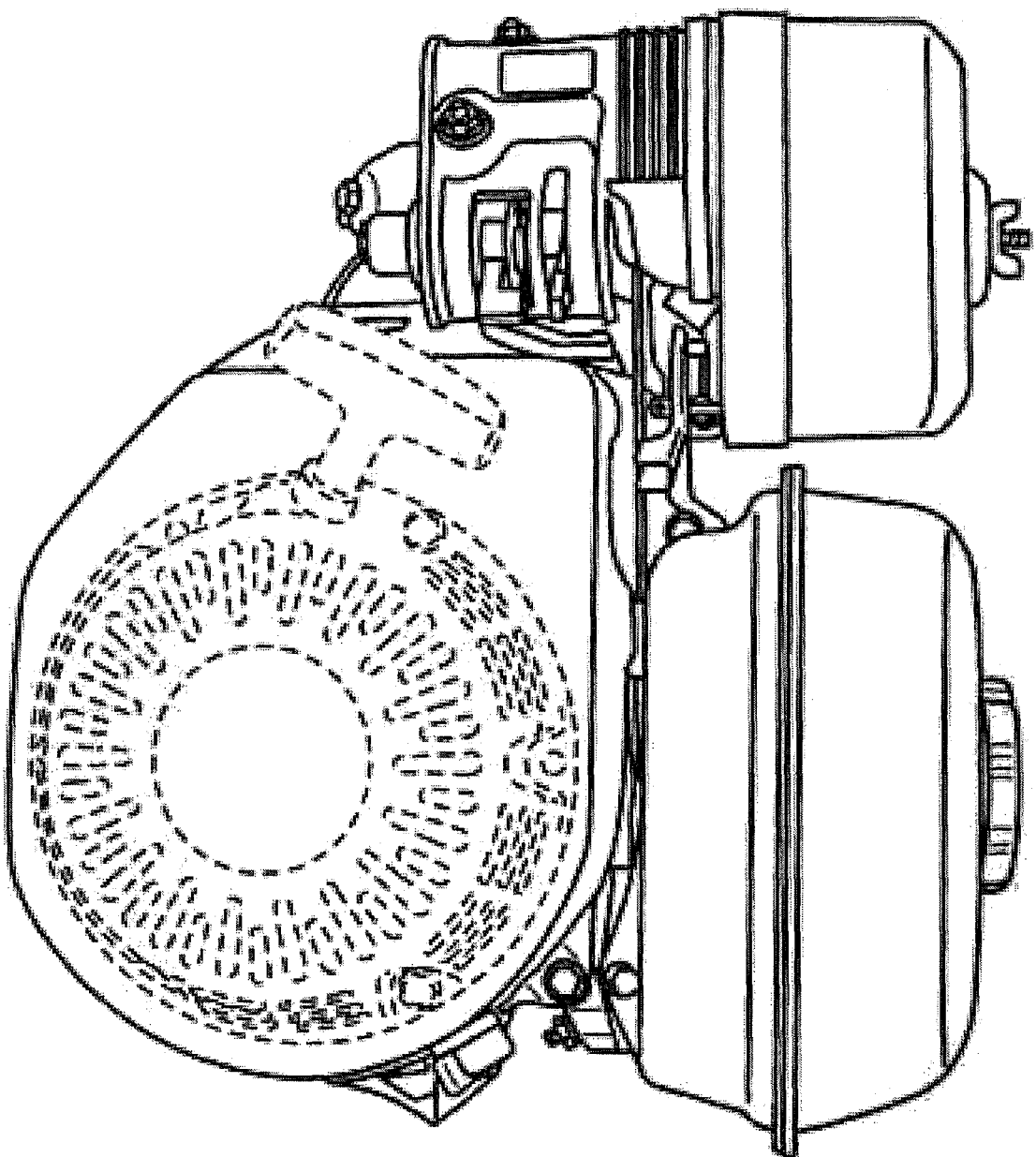
CURRENT CORRESPONDENCE INFORMATION

ATTORNEY	Michael J. Bevilacqua, Esquire
CORRESPONDENCE ADDRESS	MICHAEL J. BEVILACQUA, ESQUIRE WILMER CUTLER PICKERING HALE AND DORR LL 60 STATE ST BOSTON, MA 02109-1800
DOMESTIC REPRESENTATIVE	Michael J. Bevilacqua, Esquire

PRIOR OWNER INFORMATION

PARTY TYPE	10-ORIGINAL APPLICANT
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NAME	Honda Giken Kogyo Kabushiki Kaisha (Honda Motor Co., Ltd.)
ADDRESS	No. 1-1, 2-Chome, Minamiaoyama Minato-Ku, Tokyo, 107-8556
ENTITY	03-CORPORATION
CITIZENSHIP	Japan



Applicant's Trial Exhibit No. 7

(June 24, 2015 Deposition of Jeff Whitmore)

CONFIDENTIAL

ATTORNEYS' EYES ONLY

FILED UNDER SEAL

Applicant's Trial Exhibit No. 8

(June 24, 2015 Deposition of Jeff Whitmore)

CONFIDENTIAL

ATTORNEYS' EYES ONLY

FILED UNDER SEAL

Applicant's Trial Exhibit No. 9

(June 24, 2015 Deposition of Jeff Whitmore)

CONFIDENTIAL

ATTORNEYS' EYES ONLY

FILED UNDER SEAL